

Operating Instructions

**Radar sensor for continuous level
measurement of bulk solids**

VEGAPULS 69

HART and accumulator pack



Document ID: 47248



VEGA

Contents

1	About this document	
1.1	Function	4
1.2	Target group	4
1.3	Symbols used	4
2	For your safety	
2.1	Authorised personnel	5
2.2	Appropriate use	5
2.3	Warning about incorrect use	5
2.4	General safety instructions	5
2.5	CE conformity	6
2.6	NAMUR recommendations	6
2.7	Radio license for Europe	6
2.8	Environmental instructions	6
3	Product description	
3.1	Configuration	8
3.2	Principle of operation	9
3.3	Packaging, transport and storage	10
3.4	Accessories and replacement parts	10
4	Mounting	
4.1	General instructions	12
4.2	Mounting versions, plastic horn antenna	12
4.3	Mounting preparations, mounting strap	15
4.4	Mounting instructions	15
5	Connecting to power supply	
5.1	Connection of the battery charger	26
5.2	Wiring plan	26
5.3	Switch-on phase	27
6	Set up with the display and adjustment module	
6.1	Insert display and adjustment module	29
6.2	Adjustment system	30
6.3	Measured value indication - Selection national language	30
6.4	Parameter adjustment	31
6.5	Saving the parameter adjustment data	45
7	Setup with PACTware	
7.1	Connect the PC	46
7.2	Parameter adjustment	46
7.3	Saving the parameter adjustment data	47
8	Set up with other systems	
8.1	DD adjustment programs	48
8.2	Field Communicator 375, 475	48
9	Diagnosis, asset management and service	
9.1	Maintenance	49
9.2	Measured value and event memory	49
9.3	Asset Management function	50
9.4	Rectify faults	54

9.5	Exchanging the electronics module.....	56
9.6	Software update	57
9.7	How to proceed if a repair is needed	57
10	Dismount	
10.1	Dismounting steps.....	58
10.2	Disposal	58
11	Supplement	
11.1	Technical data	59
11.2	Radio astronomy stations.....	66
11.3	Dimensions	67



Safety instructions for Ex areas

Please note the Ex-specific safety information for installation and operation in Ex areas. These safety instructions are part of the operating instructions manual and come with the Ex-approved instruments.

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1 About this document

1.1 Function

This operating instructions manual provides all the information you need for mounting, connection and setup as well as important instructions for maintenance and fault rectification. Please read this information before putting the instrument into operation and keep this manual accessible in the immediate vicinity of the device.

1.2 Target group

This operating instructions manual is directed to trained specialist personnel. The contents of this manual should be made available to these personnel and put into practice by them.

1.3 Symbols used



Information, tip, note

This symbol indicates helpful additional information.



Caution: If this warning is ignored, faults or malfunctions can result.



Warning: If this warning is ignored, injury to persons and/or serious damage to the instrument can result.



Danger: If this warning is ignored, serious injury to persons and/or destruction of the instrument can result.



Ex applications

This symbol indicates special instructions for Ex applications.



List

The dot set in front indicates a list with no implied sequence.



Action

This arrow indicates a single action.



Sequence of actions

Numbers set in front indicate successive steps in a procedure.



Battery disposal

This symbol indicates special information about the disposal of batteries and accumulators.

2 For your safety

2.1 Authorised personnel

All operations described in this operating instructions manual must be carried out only by trained specialist personnel authorised by the plant operator.

During work on and with the device the required personal protective equipment must always be worn.

2.2 Appropriate use

The VEGAPULS 69 is a sensor for continuous level measurement. Due to the integrated accumulator the instrument is particularly suitable as a portable measuring system or test sensor for special applications.

You can find detailed information about the area of application in chapter "*Product description*".

Operational reliability is ensured only if the instrument is properly used according to the specifications in the operating instructions manual as well as possible supplementary instructions.

2.3 Warning about incorrect use

Inappropriate or incorrect use of the instrument can give rise to application-specific hazards, e.g. vessel overfill or damage to system components through incorrect mounting or adjustment.

2.4 General safety instructions

This is a state-of-the-art instrument complying with all prevailing regulations and guidelines. The instrument must only be operated in a technically flawless and reliable condition. The operator is responsible for the trouble-free operation of the instrument.

During the entire duration of use, the user is obliged to determine the compliance of the necessary occupational safety measures with the current valid rules and regulations and also take note of new regulations.

The safety instructions in this operating instructions manual, the national installation standards as well as the valid safety regulations and accident prevention rules must be observed by the user.

For safety and warranty reasons, any invasive work on the device beyond that described in the operating instructions manual may be carried out only by personnel authorised by the manufacturer. Arbitrary conversions or modifications are explicitly forbidden.

The safety approval markings and safety tips on the device must also be observed.

Depending on the instrument version, the emitting frequencies are in the C or K band range. The low emitting frequencies are far below the internationally approved limit values. When used correctly, there is no danger to health.

2.5 CE conformity

The device fulfills the legal requirements of the applicable EC guidelines. By affixing the CE marking, we confirm successful testing of the product.

You can find the CE Certificate of Conformity in the download section of our homepage.

2.6 NAMUR recommendations

NAMUR is the automation technology user association in the process industry in Germany. The published NAMUR recommendations are accepted as the standard in field instrumentation.

The device fulfills the requirements of the following NAMUR recommendations:

- NE 21 – Electromagnetic compatibility of equipment
- NE 43 – Signal level for malfunction information from measuring transducers
- NE 53 – Compatibility of field devices and display/adjustment components
- NE 107 – Self-monitoring and diagnosis of field devices

For further information see www.namur.de.

2.7 Radio license for Europe

The instrument meets the LPR (Level Probing Radar) radio standard EN 302729-1/2.

It is approved for unrestricted use inside and outside of closed vessels in countries of the EU and EFTA that have implemented this standard.

For operation outside of closed vessels, the following conditions must be fulfilled:

- The installation must be carried out by trained qualified personnel
- The instrument must be stationary mounted and the antenna directed vertically downward
- The mounting location must be at least 4 km away from the radio astronomy stations, unless special permission was granted by the responsible national approval authority
- When installed within 4 to 40 km of a radio astronomy station, the instrument must not be mounted higher than 15 m above the ground.

You can find a list with the respective radio astronomy stations in chapter "*Supplement*".

2.8 Environmental instructions

Protection of the environment is one of our most important duties. That is why we have introduced an environment management system with the goal of continuously improving company environmental protection. The environment management system is certified according to DIN EN ISO 14001.

Please help us fulfill this obligation by observing the environmental instructions in this manual:

- Chapter "*Packaging, transport and storage*"
- Chapter "*Disposal*"

3 Product description

3.1 Configuration

Type label

The type label contains the most important data for identification and use of the instrument:

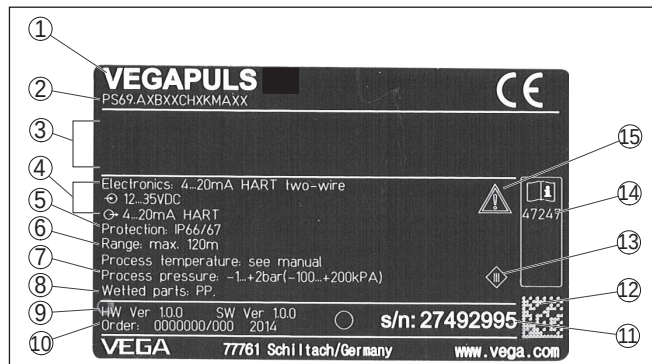


Fig. 1: Layout of the type label (example)

- 1 Instrument type
- 2 Product code
- 3 Approvals
- 4 Power supply and signal output, electronics
- 5 Protection rating
- 6 Measuring range
- 7 Process and ambient temperature, process pressure
- 8 Material, wetted parts
- 9 Hardware and software version
- 10 Order number
- 11 Serial number of the instrument
- 12 Data-Matrix-Code for Smartphone-App
- 13 Symbol of the device protection class
- 14 ID numbers, instrument documentation
- 15 Reminder to observe the instrument documentation
- 16 Notified authority for CE marking
- 17 Approval directive

Serial number - Instrument search

The type label contains the serial number of the instrument. With it you can find the following instrument data on our homepage:

- Product code (HTML)
- Delivery date (HTML)
- Order-specific instrument features (HTML)
- Operating instructions and quick setup guide at the time of shipment (PDF)
- Order-specific sensor data for an electronics exchange (XML)
- Test certificate (PDF) - optional

Go to www.vega.com, "VEGA Tools" and "Instrument search". Enter the serial number.

Alternatively, you can access the data via your smartphone:

- Download the smartphone app "VEGA Tools" from the "Apple App Store" or the "Google Play Store"
- Scan the Data Matrix code on the type label of the instrument or
- Enter the serial number manually in the app

Scope of this operating instructions manual

This operating instructions manual applies to the following instrument versions:

- Hardware version from 1.0.0
- Software version from 1.0.1

Scope of delivery

The scope of delivery encompasses:

- Radar sensor
- Documentation
 - Quick setup guide VEGAPULS 69
 - Instructions for optional instrument features
 - Ex-specific "Safety instructions" (with Ex versions)
 - if necessary, further certificates
- DVD "Software & Documents", containing
 - Operating instructions
 - Safety instructions
 - PACTware/DTM-Collection
 - Driver software



Information:

In this operating instructions manual, the optional instrument features are described. The respective scope of delivery results from the order specification.

Application area

3.2 Principle of operation

The VEGAPULS 69 is a radar sensor for continuous level measurement of bulk solids even under the most difficult process conditions and in wide measuring ranges.

It is ideal for use in high, slender silos, with poorly reflecting bulk solids such as flyash, plastic granules or wood chips as well as strong false reflections by installations. This is made possible thanks to the functional principle, a distance measurement through frequency shifting with a particularly small antenna opening angle.

The instrument is available with different antenna systems and equipment for virtually all applications and processes:

- Plastic horn antenna or metal jacketed lens antenna
- Optional or integrated rinsing air connection
- Swivelling holder with seal against the process

Functional principle

The instrument emits a continuous radar signal via its antenna. This signal is frequency modulated with a sawtooth form. The emitted signal is reflected by the medium and received by the antenna as echo.

The frequency of the received signal always deviates from the actual emitting frequency. The frequency difference is proportional to the distance and thus to the filling height. This difference is calculated

via special algorithms in the sensor electronics. The determined filling height is then converted into a corresponding output signal and outputted as the measured value.

Voltage supply

The instrument is powered via an integrated accumulator. This allows operation of the instrument independently of the mains or a control system. To achieve a longer battery lifetime, the instrument is preset to HART multidrop. This puts a load of only 4 mA current on the accumulator.

Packaging

3.3 Packaging, transport and storage

Your instrument was protected by packaging during transport. Its capacity to handle normal loads during transport is assured by a test based on ISO 4180.

The packaging of standard instruments consists of environment-friendly, recyclable cardboard. For special versions, PE foam or PE foil is also used. Dispose of the packaging material via specialised recycling companies.

Transport

Transport must be carried out in due consideration of the notes on the transport packaging. Nonobservance of these instructions can cause damage to the device.

Transport inspection

The delivery must be checked for completeness and possible transit damage immediately at receipt. Ascertained transit damage or concealed defects must be appropriately dealt with.

Storage

Up to the time of installation, the packages must be left closed and stored according to the orientation and storage markings on the outside.

Unless otherwise indicated, the packages must be stored only under the following conditions:

- Not in the open
- Dry and dust free
- Not exposed to corrosive media
- Protected against solar radiation
- Avoiding mechanical shock and vibration
- Storage and transport temperature see chapter "*Supplement - Technical data - Ambient conditions*"
- Relative humidity 20 ... 85 %

Storage and transport temperature

PLICSCOM

3.4 Accessories and replacement parts

The display and adjustment module PLICSCOM is used for measured value indication, adjustment and diagnosis. It can be inserted into the sensor or the external display and adjustment unit and removed at any time.

You can find further information in the operating instructions "*Display and adjustment module PLICSCOM*" (Document-ID 27835).

VEGACONNECT	The interface adapter VEGACONNECT enables the connection of communication-capable instruments to the USB interface of a PC. For parameter adjustment of these instruments, the adjustment software PACTware with VEGA-DTM is required. You can find further information in the operating instructions "<i>Interface adapter VEGACONNECT</i>" (Document-ID 32628).
Protective cap	The protective cover protects the sensor housing against soiling and intense heat from solar radiation. You will find additional information in the supplementary instructions manual "<i>Protective cover</i>" (Document-ID 34296).
Flanges	Screwed flanges are available in different versions according to the following standards: DIN 2501, EN 1092-1, BS 10, ANSI B 16.5, JIS B 2210-1984, GOST 12821-80. You can find additional information in the supplementary instructions manual "<i>Flanges according to DIN-EN-ASME-JIS</i>" (Document-ID 31088).
Flanges with plastic horn antenna	For mounting the instrument with plastic horn antenna to a socket, two flange versions are available: the combi compression flange and the adapter flange. You can find additional information in chapter "<i>Mounting</i>" of this operating instruction.
Mounting strap with plastic horn antenna	A mounting strap is available for mounting the instrument with plastic horn antenna to the wall or ceiling. You can find additional information in chapter "<i>Mounting</i>" of this operating instruction.
Electronics module	Electronics module "VEGAPULS series 60" is a replacement part for radar sensors of VEGAPULS series 60. A different version is available for each type of signal output. You can find further information in the operating instructions "<i>Electronics module VEGAPULS series 60</i>" (Document-ID 36801).
Supplementary electronics power pack	The supplementary electronics "Power pack" is a replacement part for sensors with integrated accumulator. You can find further information in the operating instructions "<i>Supplementary electronics for 4 ... 20 mA/HART and power pack</i>" (Document-ID 41033).

4 Mounting

4.1 General instructions

Protection against moisture

Protect your instrument against moisture ingress through the following measures:

- Use the recommended cable (see chapter "Connecting to power supply")
- Tighten the cable gland
- Loop the connection cable downward in front of the cable gland

This applies particularly to:

- Outdoor mounting
- Installations in areas where high humidity is expected (e.g. through cleaning processes)
- Installations on cooled or heated vessels

Suitability for the process conditions

Make sure that all parts of the instrument exposed to the process are suitable for the existing process conditions.

These are mainly:

- Active measuring component
- Process fitting
- Process seal

Process conditions are particularly:

- Process pressure
- Process temperature
- Chemical properties of the medium
- Abrasion and mechanical influences

You can find detailed information on the process conditions in chapter "Technical data" as well as on the type label.

4.2 Mounting versions, plastic horn antenna

Mounting strap

The optional mounting strap allows simple mounting of the instrument on a wall, ceiling or boom. Especially with open vessels, this is a simple and effective way to align the sensor to the surface of the bulk solid material.

The following versions are available:

- Length 300 mm
- Length 170 mm

Mounting strap - Ceiling mounting

The instrument is normally mounted with a strap vertically on the ceiling.

This allows swivelling the sensor up to 180° for optimal orientation and rotating for optimal connection.

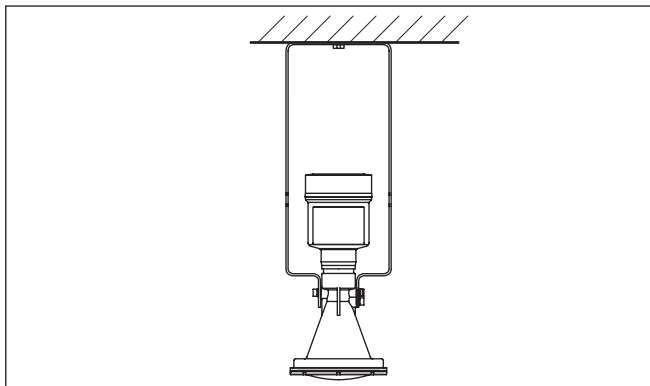


Fig. 2: Ceiling mounting via the mounting strap with length 300 mm

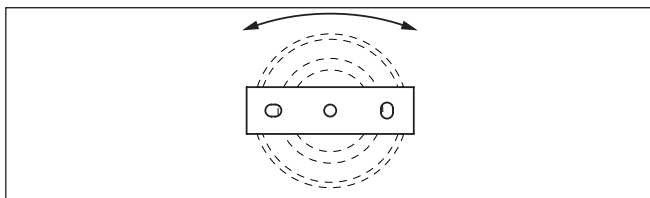


Fig. 3: Rotating with ceil mounting

Mounting strap - Wall mounting

As an alternative the strap mounting is carried out horizontally or obliquely.

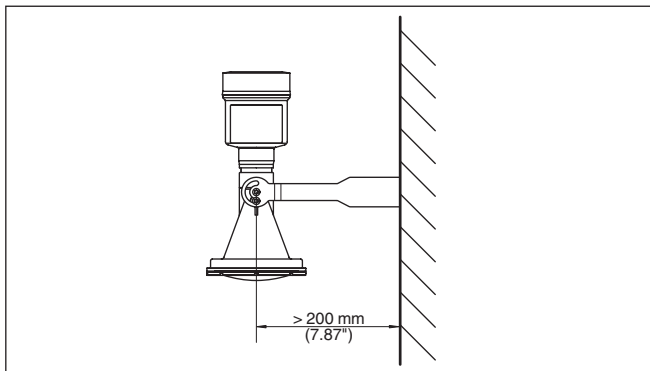


Fig. 4: Wall mounting horizontally via the mounting strap with length 170 mm

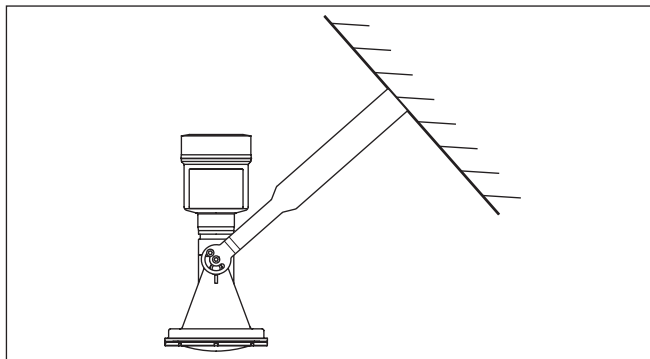


Fig. 5: Wall mounting with inclined wall via the mounting strap with length 300 mm

Flange

Two versions are available for mounting the instrument on a socket:

- Combi compression flange fitting to DN 80 (ASME 3" and JIS 80)
- Adapter flange from DN 100 (ASME 4" or JIS 100)

In the case of instruments with single chamber housing, the compression flange can be passed directly over the housing. With double chamber housings, a later mounting this way is not possible, the mounting method must be specified when ordering.

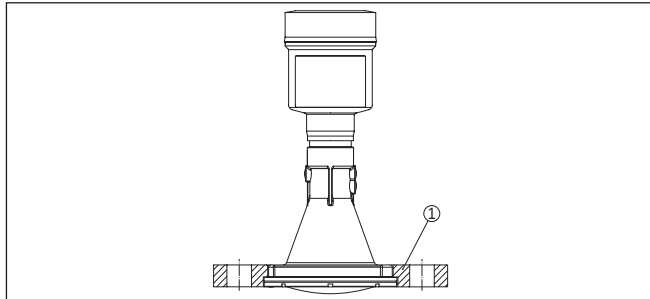


Fig. 6: Combi compression flange

1 Combi compression flange

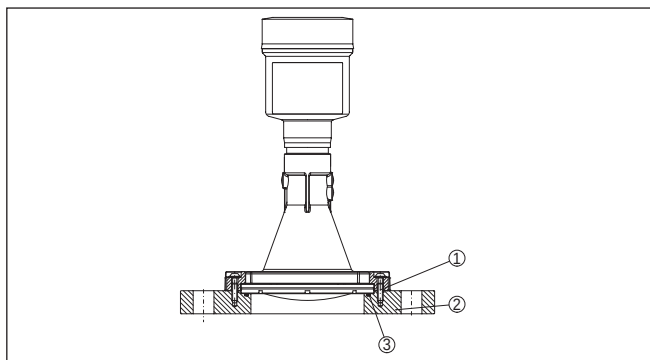


Fig. 7: Adapter flange

- 1 Connection screw
- 2 Adapter flange
- 3 Process seal

You can find drawings of these mounting options in chapter "Dimensions".

4.3 Mounting preparations, mounting strap

The strap is supplied unassembled and must be screwed to the sensor before setup with three hexagon screws M5 x 10 and spring washers. Max. torque, see chapter "Technical data". Required tools: Allen wrench size 4.

There are two ways to screw the strap onto the sensor. Depending on the selected version, the sensors can be swivelled in the strap as follows:

- Single chamber housing
 - Angle of inclination 180°, infinitely variable
 - Angle of inclination in three steps 0°, 90° and 180°
- Double chamber housing
 - Angle of inclination 90°, infinitely variable
 - Angle of inclination in two steps 0° and 90°

4.4 Mounting instructions

Polarisation

Radar sensors for level measurement emit electromagnetic waves. The polarization is the direction of the electrical component of these waves.

The polarization direction is marked by a nose on the housing, see following drawing:

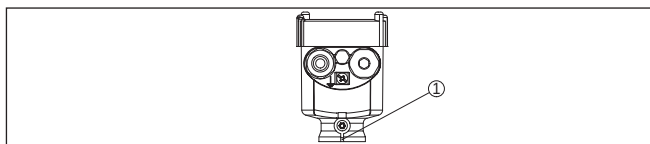


Fig. 8: Position of the polarisation

1 Nose for marking the direction of polarisation



Information:

When the housing is rotated, the direction of polarization changes and hence the influence of the false echo on the measured value. Please keep this in mind when mounting or making changes later.

Installation position

Mount the sensor at least 200 mm (7.874 in) away from the vessel wall.

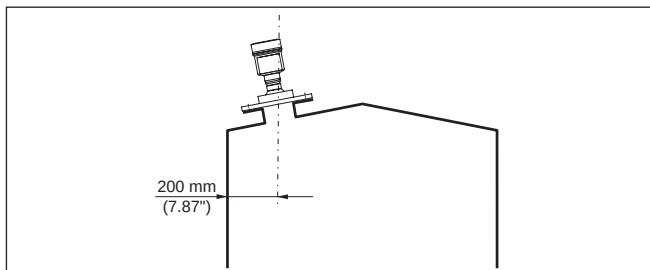


Fig. 9: Mounting the radar sensor on the vessel top

If you cannot maintain this distance, you should carry out a false signal storage during setup. This applies particularly if buildup on the vessel wall is expected. In such cases, we recommend repeating the false signal storage at a later date with existing buildup.

Inflowing medium

The instrument should not be mounted too close to the inflowing medium, as the microwave signal could be disrupted.

Silo with filling from top

The optimal mounting position is opposite the filling aperture. To avoid heavy soiling, the distance to any filter or dust exhauster should be as large as possible.

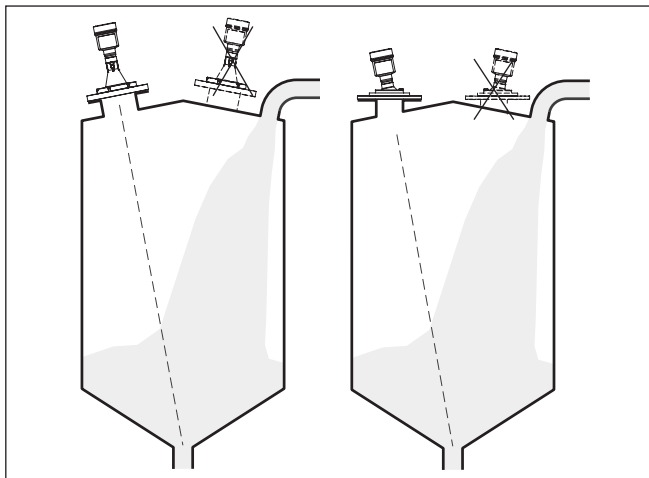


Fig. 10: Mounting of the radar sensor with inflowing medium

Silo with lateral filling

In bulk solids silos with lateral pneumatic filling the instrument should not be mounted above the filling stream, as the microwave signal will be disrupted. The optimal mounting position is next to the filling aperture. To avoid heavy soiling, the distance to any filter or dust exhauster should be as large as possible.

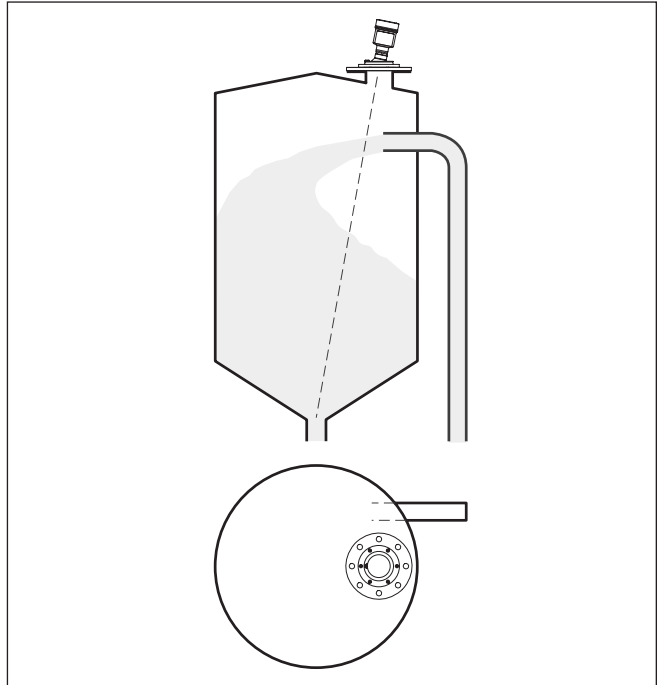


Fig. 11: Mounting of the radar sensor with inflowing medium

Type of socket



Information:

The mounting socket should be as short as possible and its end rounded. This reduces false echoes from the vessel mounting socket.

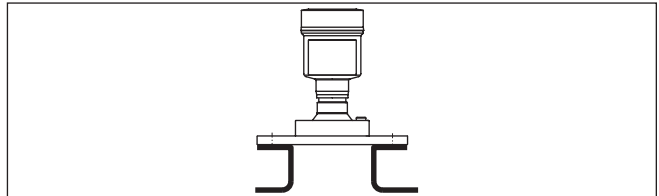


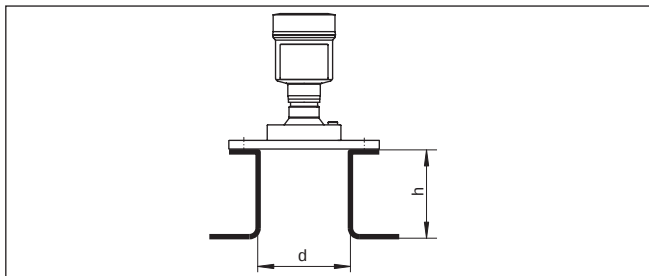
Fig. 12: Recommended socket mounting

If the medium has good reflective properties, you can also mount the VEGAPULS 69 on longer sockets. Approximate socket heights are shown in the following illustration.



Information:

When mounting on longer sockets, we recommend carrying out a false echo storage (see chapter "Parameter adjustment").



The below charts specify the max. socket piece h depending on the diameter d.

Socket diameter d	Socket length h
80 mm	≤ 200 mm
100 mm	≤ 300 mm
150 mm	≤ 500 mm

Socket diameter d	Socket length h
3"	≤ 7.87 in
4"	≤ 11.8 in
6"	≤ 19.7 in

Orientation

In order to measure as much of the vessel volume as possible, the sensor should be aligned so that the measuring beam reaches the lowest level in the vessel. In a cylindrical silo with conical outlet, the sensor is mounted anywhere from one third to one half of the vessel radius from outside wall (see following drawing).

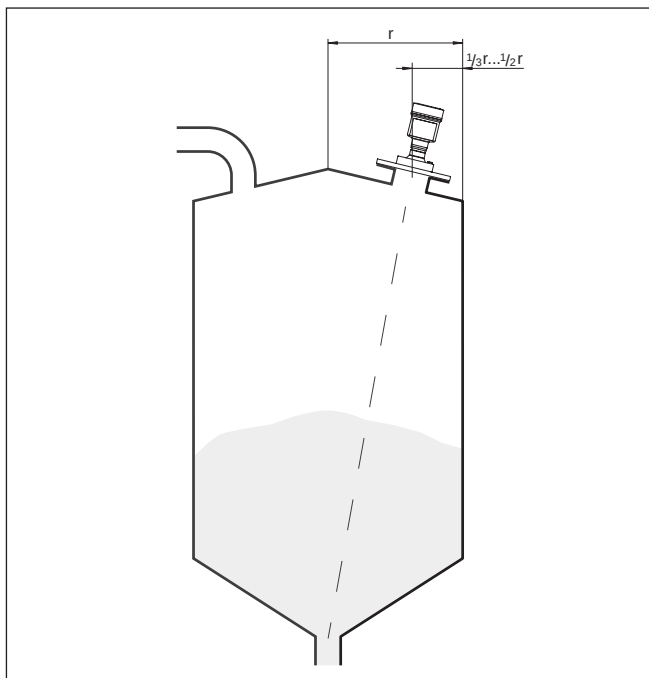


Fig. 14: Mounting position and orientation

With the help of an optional swivelling holder, the sensor can be easily aligned to the vessel centre. The necessary angle of inclination depends on the vessel dimensions. It can be easily checked with a suitable bubble tube or mechanic's level on the sensor.

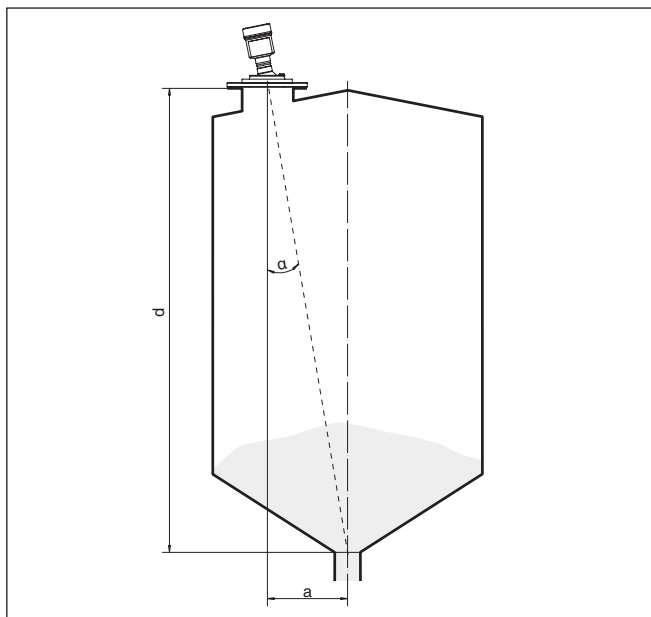


Fig. 15: Proposal for installation after orientation VEGAPULS 69

The following table shows the necessary angle of inclination. It depends on the measuring distance and the distance "a" between vessel centre and installation position.

Distance d (m)	2°	4°	6°	8°	10°
2	0.1	0.1	0.2	0.3	0.4
4	0.1	0.3	0.4	0.6	0.7
6	0.2	0.4	0.6	0.8	1.1
8	0.3	0.6	0.8	1.1	1.4
10	0.3	0.7	1.1	1.4	1.8
15	0.5	1.0	1.6	2.1	2.6
20	0.7	1.4	2.1	2.8	3.5
25	0.9	1.7	2.6	3.5	4.4
30	1	2.1	3.2	4.2	5.3
35	1.2	2.4	3.7	4.9	6.2
40	1.4	2.8	4.2	5.6	7.1
45	1.6	3.1	4.7	6.3	7.9
50	1.7	3.5	5.3	7	8.8
60	2.1	4.2	6.3	8.4	10.5
70	2.4	4.9	7.3	9.7	12.2

Distance d (m)	2°	4°	6°	8°	10°
80	2.8	5.6	8.4	11.1	13.9
90	3.1	6.3	9.4	12.5	15.6
100	3.5	7	10.5	13.9	17.4
110	3.8	7.7	11.5	15.3	19.1
120	4.2	8.4	12.5	16.7	20.8

Example:

In a vessel 20 m high, the installation position of the sensor is 1.4 m from the vessel centre.

The necessary angle of inclination of 4° can be read out from this chart.

Proceed as follows to adjust the angle of inclination with the swivelling holder:

1. Loosen the six clamping screws on the swivelling holder with a size 5 Allen wrench.
2. Align the sensor, check angle of inclination

**Information:**

The max. angle of inclination of the swivelling holder is approx. 10°

3. Tighten the clamping screws, torque max. 8 Nm.

Vessel installations

The mounting location of the radar sensor should be a place where no other equipment or fixtures cross the path of the microwave signals.

Vessel installations, such as e.g. ladders, limit switches, heating spirals, struts, etc., can cause false echoes and impair the useful echo. Make sure when planning your measuring site that the radar sensor has a "clear view" to the measured product.

In case of existing vessel installations, a false echo storage should be carried out during setup.

If large vessel installations such as struts or supports cause false echoes, these can be attenuated through supplementary measures. Small, inclined sheet metal baffles above the installations scatter the radar signals and prevent direct interfering reflections.

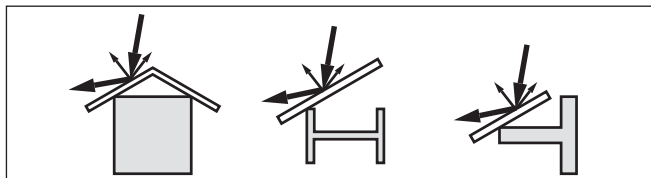


Fig. 16: Cover flat, large-area profiles with deflectors

Material heaps

Large material heaps are best measured with several instruments, which can be mounted on e.g. traverse cranes. For this type of application it is advantageous to orient the sensor perpendicular to the bulk solid surface.

The sensors do not influence each other.



Information:

Keep in mind that for these applications, the sensors are designed for relatively slow level changes. If the sensor is used on a movable boom, the max. measuring rate must be observed (see chapter "Technical data").

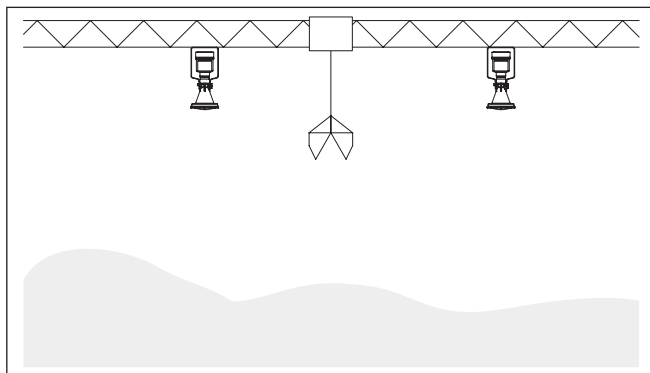


Fig. 17: Radar sensors on traverse crane

Mounting in the vessel insulation

Instruments for a temperature range up to 200° C have a spacer between process fitting and electronics housing. This spacer is used to thermally decouple the electronics from the high process temperatures.



Information:

The spacer may only be incorporated up to a maximum of 50 mm into the vessel insulation. Only then is a reliable temperature decoupling guaranteed.

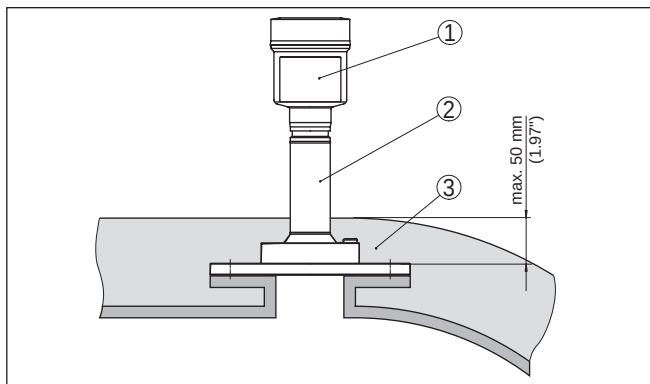


Fig. 18: Mounting the instrument on insulated vessels.

- 1 Electronics housing
- 2 Spacer
- 3 Vessel insulation

Mounting in multiple chamber silo

The walls of multiple-chamber silos are often made of profile material, e.g. profile sheeting, to ensure the required stability. If the radar sensor is mounted very close to a heavily structured vessel wall, substantial interfering reflections can be generated. Thus the sensor should be mounted at the largest possible distance from the separating wall.

The best mounting location is on the outer wall of the silo, with the sensor pointing towards the discharge opening in the silo centre. This can be accomplished, for example, with the mounting strap.

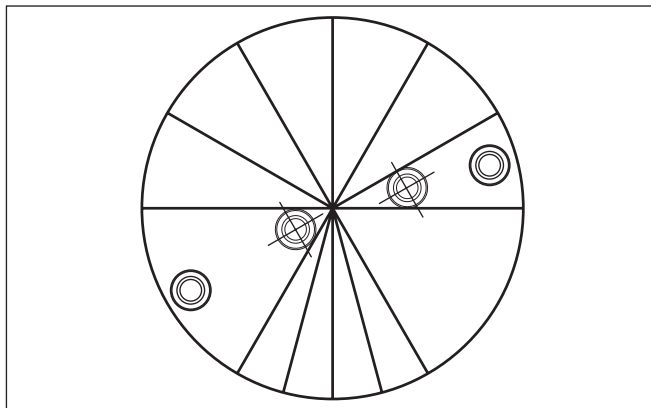


Fig. 19: Installation and orientation in multiple chamber silos

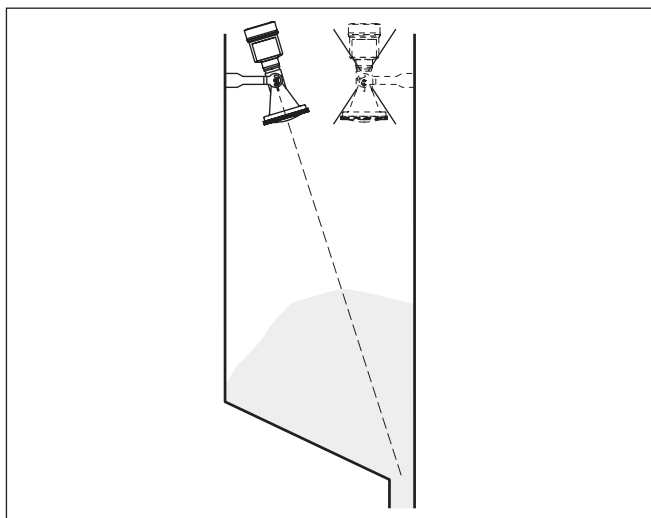


Fig. 20: Installation and orientation in multiple chamber silos

Dust deposits

To avoid heavy buildup and dust on the antenna, the sensor should not be mounted close to the dust exhaustor inside the vessel.

To avoid buildup, especially with strong condensation, air rinsing is recommended.

Metal jacketed lens antenna

The VEGAPULS 69 with metal jacketed lens antenna is equipped with a rinsing air connection as a standard feature.

Plastic horn antenna

The VEGAPULS 69 with plastic horn antenna is optionally available with rinsing air connection. The mechanical configuration differs according to the flange version.

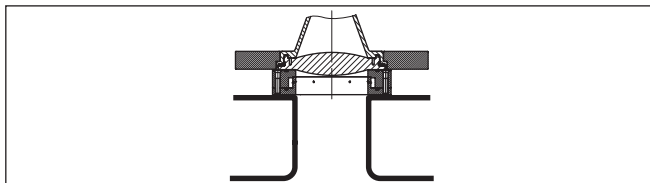


Fig. 21: Rinsing air connection with compression flange

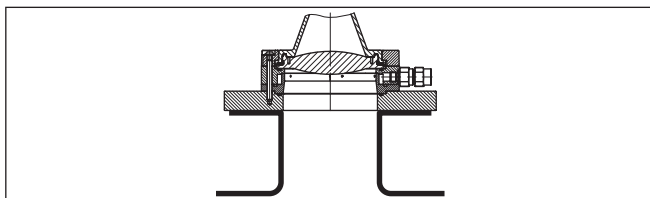


Fig. 22: Rinsing air connection with adapter flange

5 Connecting to power supply

5.1 Connection of the battery charger

We recommend charging the integrated accumulator completely before setting up the instrument. You can find the charging time in chapter "Technical data".

The battery charger is plugged into a socket in the supply room, see chapter "Wiring plan".

The LEDs in the supply room show the charging process and condition of the accumulator, see chapter "Wiring plan".

5.2 Wiring plan

Overview

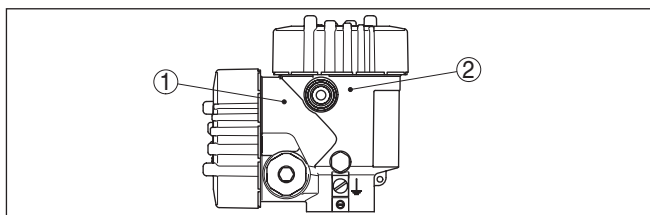


Fig. 23: Position of the power supply and electronics compartment

- 1 Supply room (accumulator)
- 2 Electronics compartment

Electronics compartment

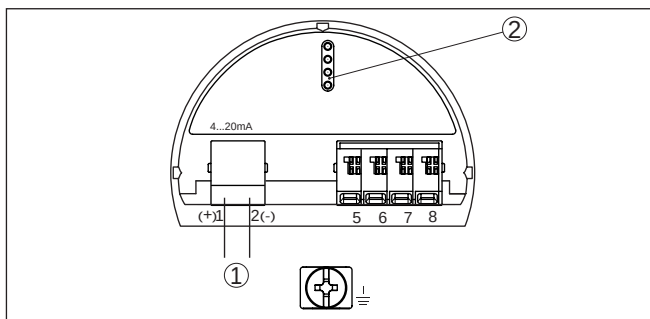


Fig. 24: Electronics compartment, double chamber housing

- 1 Internal connection to the terminal compartment
- 2 Contact pins for the display and adjustment module

Supply room

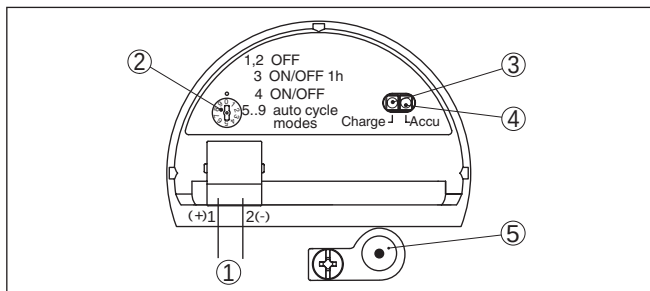


Fig. 25: Supply room

- 1 Internal connection of the socket for the battery charger
- 2 Mode switch
- 3 LED green, charging process
- 4 LED yellow, charging status
- 5 Socket for the battery charger

The mode switch enables the selection of the following modes:

- 0 = sensor off, LEDs show the accumulator status
- 1, 2 = sensor off, LEDs off
- 3 = sensor on for 1 hour after pressing a key (delivery status)
- 4 = sensor permanently on, switching on/off via button
- 5 = sensor is switched on every 30 min. for 3 min.
- 6 = sensor is switched on every hour for 3 min.
- 7 = sensor is switched on every 6 hours for 3 min.
- 8 = sensor is switched on every 12 hours for 3 min.
- 9 = sensor is switched on every 24 hours for 3 min.

The green LED characterizes the charging process:

- LED flashes = Accumulator is charging
- LED lights = accumulator is full, battery charger should be unplugged (accumulator life time)

After pressing the key or changing the mode the yellow LED shows the accumulator status for approximately 10 s as follows:

- LED lights = accumulator is full
- LED flashes = accumulator should be charged
- LED off = accumulator is empty

5.3 Switch-on phase

The instrument is switched on and off by means of a button outside on the housing.

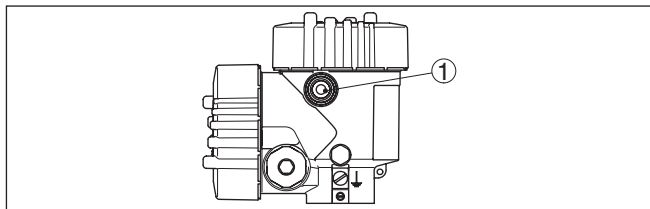


Fig. 26: Switch on/off button outside on the housing

1 On/Off button

After switching on, the instrument carries out a self-check for approximately 30 s:

- Internal check of the electronics
- Indication of the instrument type, hardware and software version, measurement loop name on the display or PC
- Indication of the status message "*F 105 Determine measured value*" on the display or PC

As soon as a plausible measured value is found, it is displayed. The value corresponds to the actual level as well as the settings already carried out, e.g. factory settings.

6 Set up with the display and adjustment module

6.1 Insert display and adjustment module

The display and adjustment module can be inserted into the sensor and removed again at any time. You can choose any one of four different positions - each displaced by 90°. It is not necessary to interrupt the power supply.

Proceed as follows:

1. Unscrew the housing cover
2. Place the display and adjustment module on the electronics in the desired position and turn it to the right until it snaps in.
3. Screw housing cover with inspection window tightly back on

Disassembly is carried out in reverse order.

The display and adjustment module is powered by the sensor, an additional connection is not necessary.



Fig. 27: Insertion of the display and adjustment module



Note:

If you intend to retrofit the instrument with a display and adjustment module for continuous measured value indication, a higher cover with an inspection glass is required.

6.2 Adjustment system

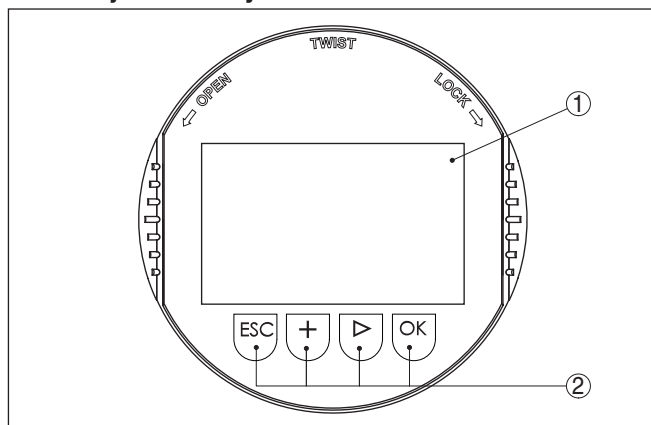


Fig. 28: Display and adjustment elements

- 1 LC display
- 2 Adjustment keys

Key functions

- **[OK]** key:
 - Move to the menu overview
 - Confirm selected menu
 - Edit parameter
 - Save value
- **[>]** key:
 - Presentation, change measured value
 - Select list entry
 - Select editing position
- **[+]** key:
 - Change value of the parameter
- **[ESC]** key:
 - Interrupt input
 - Jump to next higher menu

Adjustment system

The instrument is adjusted via the four keys of the display and adjustment module. The LC display indicates the individual menu items. The functions of the individual keys are shown in the above illustration. Approx. 60 minutes after the last pressing of a key, an automatic reset to measured value indication is triggered. Any values not confirmed with **[OK]** will not be saved.

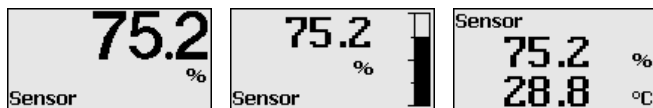
6.3 Measured value indication - Selection national language

Measured value indication

With the **[>]** key you move between three different indication modes. In the first view, the selected measured value is displayed in large digits.

In the second view, the selected measured value and a corresponding bar graph presentation are displayed.

In the third view, the selected measured value as well as a second selectable value, e.g. the temperature of the electronics, are displayed.



During the initial setup of an instrument shipped Ex works, use the "OK" key to get to the menu "National language".

Selection of national language

This menu item is used to select the national language for further parameter adjustment. You can change the selection via the menu item "Setup - Display, Menu language".



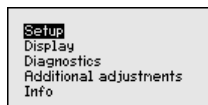
With the "OK" key you move to the main menu.

6.4 Parameter adjustment

The instrument is adapted to the application conditions via the parameter adjustment. The parameter adjustment is carried out with an adjustment menu.

Main menu

The main menu is divided into five sections with the following functions:



Setup: Settings, e.g., for measurement loop name, medium, application, vessel, adjustment, signal output

Display: Settings, e.g., for language, measured value display, lighting

Diagnosis: Information, e.g. on instrument status, pointer, measurement reliability, simulation, echo curve

Further settings: Instrument unit, false signal suppression, linearisation curve, reset, date/time, reset, copy function

Info: Instrument name, hardware and software version, date of manufacture, instrument features



Information:

In this operating instructions manual, the instrument-specific parameters in the menu sections "Setup", "Diagnosis" and "Additional settings" are described. The general parameters in these menu section are described in the operating instructions manual "Indicating and adjustment module".

You can find in the operating instructions manual "*Display and adjustment module*" also the description of the menu sections "*Display*" and "*Info*".

In the main menu point "*Setup*", the individual submenu points should be selected one after the other and provided with the correct parameters to ensure optimum adjustment of the measurement. The procedure is described in the following.

Setup

Setup - Medium

Each medium has different reflection properties. With liquids, further interfering factors are fluctuation product surface and foam generation. With bulk solids, these are dust generation, material cone and additional echoes from the vessel wall.

To adapt the sensor to these different measuring conditions, the selection "*Liquid*" or "*Bulk solid*" should be made in this menu item.

Setup Measurement loop name Medium Application Vessel type Vessel height/Me. range ▼	Medium Liquid Water based ▼	Solvent Chem. mixtures ✓ Water based
Medium Solid Ballast/pebbles ▼	Medium Powder/dust Granules/pellets ✓ Ballast/pebbles	

Through this selection, the sensor is adapted perfectly to the product and measurement reliability, particularly in products with poor reflective properties, is considerably increased.

Enter the requested parameters via the appropriate keys, save your settings with **[OK]** and jump to the next menu item with the **[ESC]** and the **[→]** key.

Setup - Application

In addition to the medium, also the application, i.e. the measuring site, can influence the measurement.

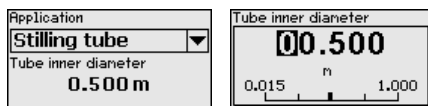
With this menu item, the sensor can be adapted to the applications. The adjustment possibilities depend on the selection "*Liquid*" or "*Bulk solid*" under "*Medium*".

Setup Measurement loop name Medium Application Vessel type Vessel height/Me. range ▼

The following options are available when "*Liquid*" is selected:

Application ✓ Storage tank Storage tank agitation Storage tank on ships Stirred vessel Dosing vessel ▼	Application Stilling tube ✓ Bypass Plastic vessel Mob.plastic vessel Open waters ▼	Application Mob.plastic vessel Open waters ✓ Open flume Rainwater overfall Demonstration ▼
---	---	---

The selection "*Standpipe*" opens a new window in which the inner diameter of the applied standpipe is entered.



The following features form the basis of the applications:

Storage tank:

- Setup: large-volumed, upright cylindrical, spherical
- Product speed: slow filling and emptying
- Process/measurement conditions:
 - Condensation
 - Smooth product surface
 - High requirements to the measurement accuracy
- Properties, sensor:
 - Slight sensitivity against sporadic false echoes
 - Stable and reliable measured values through averaging
 - High accuracy
 - Short reaction time of the sensor not required

Storage tank with product circulation:

- Setup: large-volumed, upright cylindrical, spherical
- Product speed: slow filling and emptying
- Installations: small laterally mounted or large top mounted stirrer
- Process/measurement conditions:
 - Relatively smooth product surface
 - High requirements to the measurement accuracy
 - Condensation
 - Slight foam generation
 - Overfilling possible
- Properties, sensor:
 - Slight sensitivity against sporadic false echoes
 - Stable and reliable measured values through averaging
 - High accuracy because not adjusted for max. speed
 - False signal suppression recommended

Storage tank on ships (Cargo Tank):

- Product speed: slow filling and emptying
- Vessel:
 - Installations in the bottom section (bracers, heating spirals)
 - High sockets 200 ... 500 mm, also with large diameters
- Process/measurement conditions:
 - Condensation, buildup by movement
 - Max. requirement on measurement accuracy from 95 %
- Properties, sensor:
 - Slight sensitivity against sporadic false echoes
 - Stable and reliable measured values through averaging
 - High accuracy
 - False signal suppression required

Stirrer vessel (reactor):

- Setup: all vessel sizes possible
- Product speed:

- Fast to slow filling possible
- Vessel is very often filled and emptied
- Vessel:
 - Socket available
 - Large agitator blades of metal
 - Vortex breakers, heating spirals
- Process/measurement conditions:
 - Condensation, buildup by movement
 - Strong spout generation
 - Very agitated surface, foam generation
- Properties, sensor:
 - Higher measurement speed through lower averaging
 - Sporadic false echoes are suppressed

Dosing vessel:

- Setup: all vessel sizes possible
- Product speed:
 - Fast filling and emptying
 - Vessel is very often filled and emptied
- Vessel: narrow installation situation
- Process/measurement conditions:
 - Condensation, buildup on the antenna
 - Foam generation
- Properties, sensor:
 - Measurement speed optimized by virtually no averaging
 - Sporadic false echoes are suppressed
 - False signal suppression recommended

Standpipe:

- Product speed: very fast filling and emptying
- Vessel:
 - Vent hole
 - Joins like flanges, weld joints
 - Shifting of the running time in the tube
- Process/measurement conditions:
 - Condensation
 - Buildup
- Properties, sensor:
 - Measurement speed optimized through little averaging
 - Entering the tube inside diameter takes the running time shift into consideration
 - Echo detection sensitivity reduced

Bypass:

- Product speed:
 - Fast up to slow filling with short up to long bypass tube possible
 - Often the level is hold via a control facility
- Vessel:
 - Lateral outlets and inlets
 - Joins like flanges, weld joints
 - Shifting of the running time in the tube
- Process/measurement conditions:
 - Condensation

- Buildup
- Separation of oil and water possible
- Overfilling into the antenna possible
- Properties, sensor:
 - Measurement speed optimized through little averaging
 - Entering the tube inside diameter takes the running time shift into consideration
 - Echo detection sensitivity reduced
 - False signal suppression recommended

Plastic tank:

- Vessel:
 - Measurement fix mounted or integrated
 - Measurement depending on the application through the vessel top
 - With empty vessel, the measurement can be carried out through the bottom
- Process/measurement conditions:
 - Condensation on the plastic ceiling
 - In outside facilities water and snow on the vessel top possible
- Properties, sensor:
 - False signals outside the vessel are not taken into consideration
 - False signal suppression recommended

Transportable plastic tank:

- Vessel:
 - Material and thickness different
 - Measurement through the vessel top
- Process/measurement conditions:
 - Measured value jump with vessel change
- Properties, sensor:
 - Quick adaptation to changing reflection conditions through vessel change
 - False signal suppression required

Open water (gauge measurement):

- Gauge rate of change: slow gauge change
- Process/measurement conditions:
 - Distance sensor to water surface to big
 - Extreme damping of output signal due to wave generation
 - Ice and condensation on the antenna possible
 - Spiders and insect nestle in the antennas
 - Floating material and animals sporadically on the water surface
- Properties, sensor:
 - Stable and reliable measured values through high averaging
 - Insensitive in the close range

Open flume (flow measurement):

- Gauge rate of change: slow gauge change
- Process/measurement conditions:
 - Ice and condensation on the antenna possible
 - Spiders and insect nestle in the antennas
 - Smooth water surface

- Exact measurement result required
- Distance to the water surface normally relatively high
- Properties, sensor:
 - Stable and reliable measured values through high averaging
 - Insensitive in the close range

Rain water overfall (weir):

- Gauge rate of change: slow gauge change
- Process/measurement conditions:
 - Ice and condensation on the antenna possible
 - Spiders and insect nestle in the antennas
 - Turbulent water surface
 - Sensor flooding possible
- Properties, sensor:
 - Stable and reliable measured values through high averaging
 - Insensitive in the close range

Demonstration:

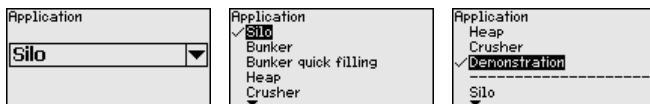
- Adjustment for all applications which are not typically level measurement
 - Instrument demonstration
 - Object recognition/monitoring (additional settings required)
- Properties, sensor:
 - Sensor accepts all measured value changes within the measuring range immediately
 - High sensitivity against interferences, because virtually no averaging

**Caution:**

If liquids with different dielectric constants separate in the vessel, for example through condensation, the radar sensor can detect under certain circumstances only the medium with the higher dielectric constant. Keep in mind that layer interfaces can cause faulty measurements.

If you want to measure the total height of both liquids reliably, please contact our service department or use an instrument specially designed for interface measurement.

The following options are available when "Bulk solid" is selected:



The following features form the basis of the applications:

Silo (slender and high):

- Vessel of metal: weld joints
- Process/measurement conditions:
 - Filling aperture too close to the sensor
 - System noise in completely empty silo increased
- Properties, sensor:
 - Stable measured values through higher averaging

- False signal suppression during setup recommended, required for automatic false signal suppression
- Automatic false signal suppression with partly filled vessel

Bunker (large-volume):

- Vessel of concrete or metal:
 - Structured vessel walls
 - Installations present
- Process/measurement conditions:
 - Large distance to the medium
 - Large angles of repose
- Properties, sensor:
 - Mean averaging
 - High measured value jumps are accepted

Bunker with fast filling:

- Vessel of concrete or metal, also multiple chamber silo:
 - Structured vessel walls
 - Installations present
- Process/measurement conditions:
 - Measured value jumps, e.g. through truck loading
 - Large distance to the medium
 - Large angles of repose
- Properties, sensor:
 - Lower averaging
 - Very high measured value jumps are accepted

Heap:

- Sensor mounting on movable conveyor belts
- Detection of the heap profile
- Height detection during filling
- Process/measurement conditions:
 - Measured value jumps, e.g. by the profile of the heap or traverses
 - Large angles of repose
 - Measurement near the filling stream
- Properties, sensor:
 - Mean averaging
 - High measured value jumps are accepted

Crusher:

- Vessel: installations, wear and protective facilities available
- Process/measurement conditions:
 - Measured value jumps, e.g. through truck loading
 - Fast reaction time
 - Large distance to the medium
- Properties, sensor:
 - Little averaging
 - Max. reaction speed, very high measured value jumps are accepted

Demonstration:

- Adjustment for all applications which are not typically level measurement
 - Instrument demonstration
 - Object recognition/monitoring (additional settings required)
- Properties, sensor:
 - Sensor accepts all measured value changes within the measuring range immediately
 - High sensitivity against interferences, because virtually no averaging

Through this selection, the sensor is adapted optimally to the application or the location and measurement reliability under the various basic conditions is increased considerably.

Enter the requested parameters via the appropriate keys, save your settings with **[OK]** and jump to the next menu item with the **[ESC]** and the **[→]** key.

Setup - Vessel height, measuring range

With this selection, the operating range of the sensor is adapted to the vessel height and the reliability with different frame conditions is increased considerably.

The min. adjustment must be carried out independently of this.

Setup Medium Application Vessel type Vessel height/Me. range Max. adjustment ▼	Vessel height/Meas. range 35.000m
---	---

Enter the requested parameters via the appropriate keys, save your settings with **[OK]** and jump to the next menu item with the **[ESC]** and the **[→]** key.

Setup - Vessel form

Also the vessel form can influence the measurement apart from the medium and the application. To adapt the sensor to these measurement conditions, this menu item offers you different options for vessel bottom and ceiling in case of certain applications.

Setup Medium Application Vessel type Vessel height/Me. range Max. adjustment ▼	Vessel bottom ☒ Straight ☐ Conical ☐ Angular	Vessel top ☐ Straight ☒ Dished boiler
---	--	---

Enter the requested parameters via the appropriate keys, save your settings with **[OK]** and jump to the next menu item with the **[ESC]** and the **[→]** key.

Setup - Adjustment

Since the radar sensor is a distance measuring instrument, the distance from the sensor to the product surface is measured. For indication of the real level, an allocation of the measured distance to the percentage height must be carried out.

To perform the adjustment, enter the distance with full and empty vessel, see the following example:

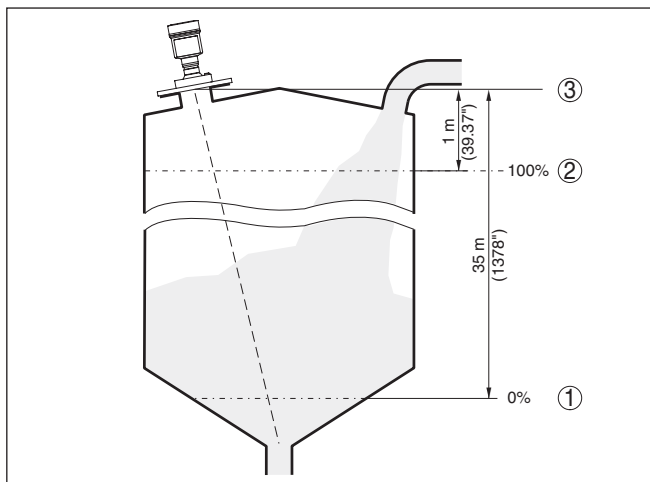


Fig. 29: Parameter adjustment example min./max. adjustment

- 1 Min. level = max. meas. distance
- 2 Max. level = min. meas. distance
- 3 Reference plane

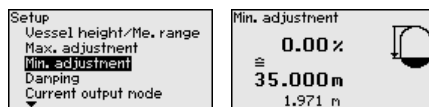
If these values are not known, an adjustment with the distances of for example 10 % and 90 % is possible. Starting point for these distance specifications is always the seal surface of the thread or flange. You can find specifications of the reference plane in chapter "Technical data". By means of these settings, the real level will be calculated.

The real product level during this adjustment is not important, because the min./max. adjustment is always carried out without changing the product level. These settings can be made ahead of time without the instrument having to be installed.

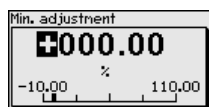
Setup - Min. adjustment

Proceed as follows:

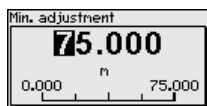
1. Select the menu item "Setup" with [->] and confirm with [OK].
Now select with [->] the menu item "Min. adjustment" and confirm with [OK].



2. Edit the percentage value with [OK] and set the cursor to the requested position with [->].



3. Set the requested percentage value with [+] and save with [OK].
The cursor jumps now to the distance value.

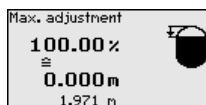
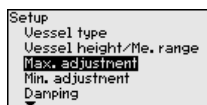


4. Enter the suitable distance value in m for the empty vessel (e.g. distance from the sensor to the vessel bottom) corresponding to the percentage value.
5. Save settings with **[OK]** and move with **[ESC]** and **[>]** to the max. adjustment.

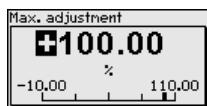
Setup - Max. adjustment

Proceed as follows:

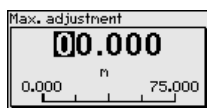
1. Select with **[>]** the menu item "Max. adjustment" and confirm with **[OK]**.



2. Prepare the percentage value for editing with **[OK]** and set the cursor to the requested position with **[>]**.



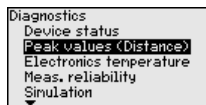
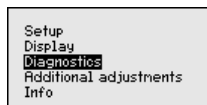
3. Set the requested percentage value with **[+]** and save with **[OK]**. The cursor jumps now to the distance value.



4. Enter the appropriate distance value in m (corresponding to the percentage value) for the full vessel. Keep in mind that the max. level must lie below the min. distance to the antenna edge.
5. Save settings with **[OK]**

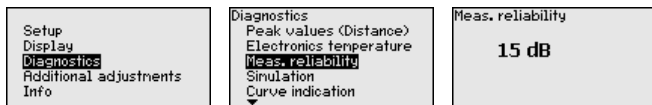
Diagnosis - Peak value

The respective min. and max. measured value is saved in the sensor. The values are displayed in the menu item "Peak values".



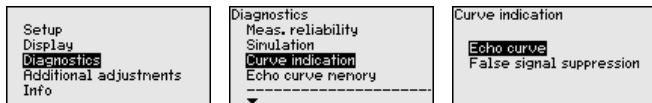
Diagnosis - Measurement reliability

When non-contact level sensors are used, the measurement can be influenced by the respective process conditions. In this menu item, the measurement reliability of the level echo is displayed as dB value. The measurement reliability equals signal strength minus noise. The higher the value, the more reliable the measurement. With a functioning measurement, the values are > 10 dB.



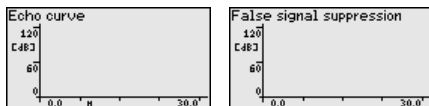
Diagnoses - Curve indication

The "Echo curve" shows the signal strength of the echoes over the measuring range in dB. The signal strength enables an evaluation of the quality of the measurement.



The "False signal suppression" displays the saved false echoes (see menu "Additional settings") of the empty vessel with signal strength in "dB" over the measuring range.

A comparison of echo curve and false signal suppression allows a more detailed statement of the reliability.



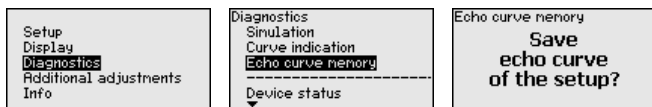
The selected curve is continuously updated. A submenu with zoom functions is opened with the [OK] key:

- "X-Zoom": Zoom function for the meas. distance
- "Y-Zoom": 1, 2, 5 and 10x signal magnification in "dB"
- "Unzoom": Reset the presentation to the nominal measuring range without magnification

Diagnoses - Echo curve memory

With the function "Echo curve memory" the echo curve can be saved at the time of setup. This is generally recommended; for using the Asset Management functions it is absolutely necessary. If possible, the curve should be saved with a low level in the vessel.

With the adjustment software PACTware and the PC, the high resolution echo curve can be displayed and used to recognize signal changes over the operating time. In addition, the echo curve of the setup can be also displayed in the echo curve window and compared with the actual echo curve.



Additional adjustments - False signal suppression

The following circumstances cause interfering reflections and can influence the measurement:

- High sockets
- Vessel installations such as struts
- Agitators
- Buildup or welded joints on vessel walls

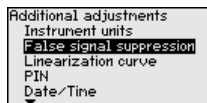
**Note:**

A false signal suppression detects, marks and saves these false signals so that they are no longer taken into account in the level measurement.

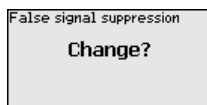
This should be done with a low level so that all potential interfering reflections can be detected.

Proceed as follows:

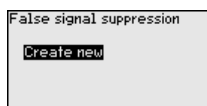
1. Select with **[>]** the menu item "*False signal suppression*" and confirm with **[OK]**.



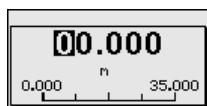
2. Confirm again with **[OK]**.



3. Confirm again with **[OK]**.



4. Confirm again with **[OK]** and enter the actual distance from the sensor to the product surface.

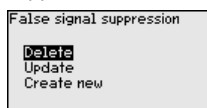


5. All interfering signals in this section are detected by the sensor and stored after confirming with **[OK]**.

**Note:**

Check the distance to the product surface, because if an incorrect (too large) value is entered, the existing level will be saved as false signal. The filling level would then no longer be detectable in this area.

If a false signal suppression has already been created in the sensor, the following menu window appears when selecting "*False signal suppression*":



Delete: An already created false signal suppression will be completely deleted. This is useful if the saved false signal suppression no longer matches the metrological conditions in the vessel.

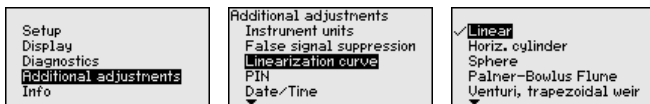
Extend: is used to extend an already created false signal suppression. This is useful if a false signal suppression was carried out with

a too high level and not all false signals could be detected. When selecting "Extend", the distance to the product surface of the created false signal suppression is displayed. This value can now be changed and the false signal suppression can be extended to this range.

Additional adjustments - Linearization curve

A linearisation is necessary for all vessels in which the vessel volume does not increase linearly with the level - e.g. a horizontal cylindrical or spherical tank - and the indication or output of the volume is required. Corresponding linearisation curves are preprogrammed for these vessels. They represent the correlation between the level percentage and vessel volume.

By activating the appropriate curve, the volume percentage of the vessel is displayed correctly. If the volume should not be displayed in percent but e.g. in l or kg, a scaling can be also set in the menu item "Display".



Enter the requested parameters via the appropriate keys, save your settings and jump to the next menu item with the **[ESC]** and **[->]** key.



Caution:

Note the following if instruments with appropriate approval are used as part of an overfill protection system according to WHG:

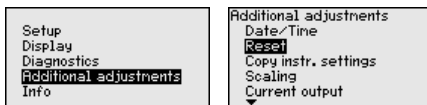
If a linearisation curve is selected, the measuring signal is no longer necessarily linear to the filling height. This must be considered by the user especially when adjusting the switching point on the limit signal transmitter.

Additional adjustments - Reset

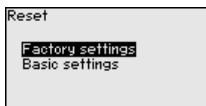
During a reset, the parameter settings carried out by the user are reset to the default values (see below table).

Proceed as follows:

1. Select with **[->]** under "Additional adjustment" the menu item "Reset" and confirm with **[OK]**.



2. Confirm with **[OK]** and select the requested reset function with **[->]**



3. Confirm with **[OK]**, for approx. 5 s the message "Resetting" is displayed, then the selection window appears.

**Caution:**

For the duration of the reset, the set trouble signal is outputted via the current output. Within the context of the asset management function, the message "Maintenance" is outputted.

The following reset functions are available:

Delivery status: Restores the parameter settings at the time of shipment from the factory, incl. the order-specific settings. Any created false signal suppression, user-programmable linearization curve as well as measured value and echo curve memory is deleted. The event and parameter modification memories remain unaffected.

Basic settings: Resets the parameter settings, incl. special parameters, to the default values of the respective instrument. Any stored false signal suppression or user programmable linearisation curve, as well as the measured value memory, is deleted. Order-related settings are not taken over into the current parameters after this reset.

The following table shows the scope of the reset function and the default values of the instrument:

Menu	Menu item	Default value
Setup	Measurement loop name	Sensor
	Units	Distance in m Temperature in °C
	Application	Medium: Crushed stones/gravel Application: Silo Vessel bottom: Flat Vessel height/Measuring range: 120 m
	Min. adjustment	120 m
	Max. adjustment	0,000 m(d)
	Damping	0.0 s
	Current output mode	Output characteristics: 4 ... 20 mA Failure mode: < 3.6 mA ▼
	Current output Min./Max.	Min. current: 3.8 mA ▼ Max. current: 20.5 mA
Display	Displayed value 1	Filling height
	Displayed value 2	Temperature
	Backlight	Switched off

Menu	Menu item	Default value
Additional adjustments	Date/Time	Time format: 24 h
	Scaling size	Volume l
	Scaling format	100.00 lin %, 100 l 0.00 lin %, 0 l
	Current output 1 and 2 size	Lin %
	Current output 1 and 2 adjustment	100.00 %, 100 l 0.00 %, 0 l
	Linearization	Linear
	HART mode	HART address: 0 Loop current mode: Analogue current output

6.5 Saving the parameter adjustment data

We recommended noting the adjusted data, e.g. in this operating instructions manual, and archiving them afterwards. They are thus available for multiple use or service purposes.

If the instrument is equipped with a display and adjustment module, the data in the sensor can be saved in the display and adjustment module. The procedure is described in the operating instructions manual "*Display and adjustment module*" in the menu item "*Copy sensor data*". The data remain there permanently even if the sensor power supply fails.

The following data or settings for adjustment of the display and adjustment module are saved:

- All data of the menu "*Setup*" and "*Display*"
- In the menu "*Additional adjustments*" the items "*Sensor-specific units, temperature unit and linearization*"
- The values of the user programmable linearization curve

The function can also be used to transfer settings from one instrument to another instrument of the same type. If it is necessary to exchange a sensor, the display and adjustment module is inserted into the replacement instrument and the data are likewise written into the sensor via the menu item "*Copy sensor data*".

7 Setup with PACTware

7.1 Connect the PC

Via the interface adapter directly on the sensor

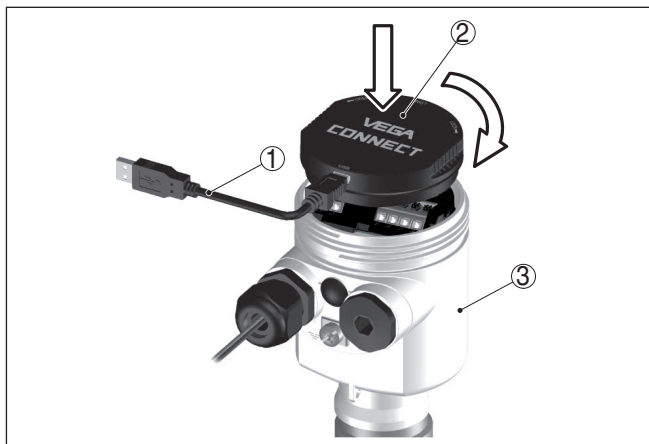


Fig. 30: Connection of the PC directly to the sensor via the interface adapter

- 1 USB cable to the PC
- 2 Interface adapter VEGACONNECT
- 3 Sensor

7.2 Parameter adjustment

Prerequisites

For parameter adjustment of the instrument via a Windows PC, the configuration software PACTware and a suitable instrument driver (DTM) according to FDT standard are required. The latest PACTware version as well as all available DTMs are compiled in a DTM Collection. The DTMs can also be integrated into other frame applications according to FDT standard.



Note:

To ensure that all instrument functions are supported, you should always use the latest DTM Collection. Furthermore, not all described functions are included in older firmware versions. You can download the latest instrument software from our homepage. A description of the update procedure is also available in the Internet.

Further setup steps are described in the operating instructions manual "DTM Collection/PACTware" attached to each DTM Collection and which can also be downloaded from the Internet. Detailed descriptions are available in the online help of PACTware and the DTMs.

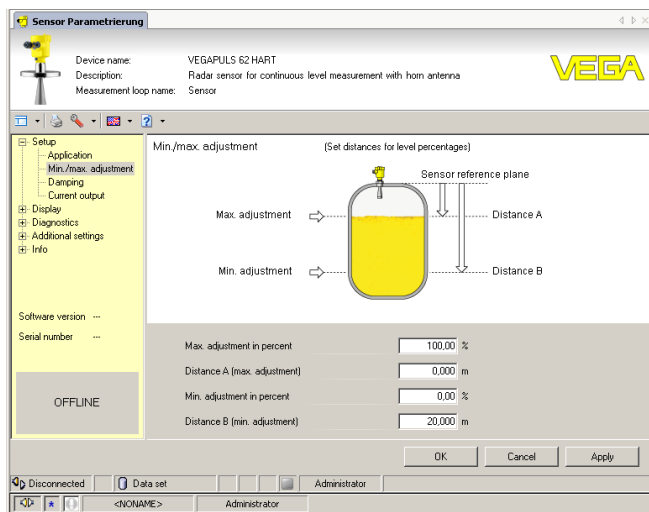


Fig. 31: Example of a DTM view

Standard/Full version

All device DTMs are available as a free-of-charge standard version and as a full version that must be purchased. In the standard version, all functions for complete setup are already included. An assistant for simple project configuration simplifies the adjustment considerably. Saving/printing the project as well as import/export functions are also part of the standard version.

In the full version there is also an extended print function for complete project documentation as well as a save function for measured value and echo curves. In addition, there is a tank calculation program as well as a multiviewer for display and analysis of the saved measured value and echo curves.

The standard version is available as a download under www.vega.com/downloads and "Software". The full version is available on CD from the agency serving you.

7.3 Saving the parameter adjustment data

We recommend documenting or saving the parameter adjustment data via PACTware. That way the data are available for multiple use or service purposes.

8 Set up with other systems

8.1 DD adjustment programs

Device descriptions as Enhanced Device Description (EDD) are available for DD adjustment programs such as, for example, AMS™ and PDM.

The files can be downloaded at www.vega.com/downloads under "Software".

8.2 Field Communicator 375, 475

Device descriptions for the instrument are available as EDD for parameter adjustment with the Field Communicator 375 or 475.

For the integration of the EDD in the Field Communicator 375 or 475, the software "Easy Upgrade Utility" is required which is available from the manufacturer. This software is updated via the Internet and new EDDs are automatically taken over into the device catalogue of this software after they are released by the manufacturer. They can then be transferred to a Field Communicator.

9 Diagnosis, asset management and service

9.1 Maintenance

If the device is used correctly, no maintenance is required in normal operation.

In some applications, buildup on the antenna system can influence the measuring result. Depending on the sensor and application, make arrangements to avoid strong pollution of the antenna system. If necessary, clean the antenna system in certain intervals.

9.2 Measured value and event memory

The instrument has several memories which are available for diagnosis purposes. The data remain even with voltage interruption.

Measured value memory

Up to 100,000 measured values can be stored in the sensor in a ring memory. Each entry contains date/time as well as the respective measured value. Storable values are for example:

- Distance
- Filling height
- Percentage value
- Lin. percent
- Scaled
- Current value
- Meas. reliability
- Electronics temperature

When the instrument is shipped, the measured value memory is active and stores distance, measurement reliability and electronics temperature every 3 minutes.

The requested values and recording conditions are set via a PC with PACTware/DTM or the control system with EDD. Data are thus read out and also reset.

Event memory

Up to 500 events are automatically stored with a time stamp in the sensor (non-deletable). Each entry contains date/time, event type, event description and value. Event types are for example:

- Modification of a parameter
- Switch-on and switch-off times
- Status messages (according to NE 107)
- Error messages (according to NE 107)

The data are read out via a PC with PACTware/DTM or the control system with EDD.

Echo curve memory

The echo curves are stored with date and time and the corresponding echo data. The memory is divided into two sections:

Echo curve of the setup: This is used as reference echo curve for the measurement conditions during setup. Changes in the measurement conditions during operation or buildup on the sensor can thus be recognized. The echo curve of the setup is stored via:

- PC with PACTware/DTM
- Control system with EDD
- Display and adjustment module

Further echo curves: Up to 10 echo curves can be stored in a ring buffer in this memory section. Further echo curves are stored via:

- PC with PACTware/DTM
- Control system with EDD

9.3 Asset Management function

The instrument features self-monitoring and diagnostics according to NE 107 and VDI/VDE 2650. In addition to the status messages in the following tables there are more detailed error messages available under the menu item "Diagnostics" via the display and adjustment module, PACTware/DTM and EDD.

Status messages

The status messages are divided into the following categories:

- Failure
- Function check
- Out of specification
- Maintenance requirement

and explained by pictographs:

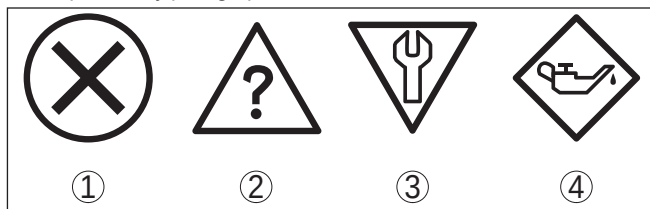


Fig. 32: Pictographs of the status messages

- 1 Failure - red
- 2 Out of specification - yellow
- 3 Function check - orange
- 4 Maintenance - blue

Failure: Due to a malfunction in the instrument, a failure message is outputted.

This status message is always active. It cannot be deactivated by the user.

Function check: The instrument is in operation, the measured value is temporarily invalid (for example during simulation).

This status message is inactive by default. It can be activated by the user via PACTware/DTM or EDD.

Out of specification: The measured value is unstable because the instrument specification is exceeded (e.g. electronics temperature).

This status message is inactive by default. It can be activated by the user via PACTware/DTM or EDD.

Maintenance: Due to external influences, the instrument function is limited. The measurement is affected, but the measured value is still valid. Plan in maintenance for the instrument because a failure is expected in the near future (e.g. due to buildup).

This status message is inactive by default. It can be activated by the user via PACTware/DTM or EDD.

Failure

The following table shows the error codes in the status message "Failure" and gives information on the reason and rectification. Keep in mind that some information is only valid with four-wire instruments.

Code Text message	Cause	Rectification
F013 no measured value available	– Sensor does not detect an echo during operation – Antenna system dirty or defective	– Check or correct installation and/or parameter adjustment – Clean or exchange process component or antenna
F017 Adjustment span too small	– Adjustment not within specification	– Change adjustment according to the limit values (difference between min. and max. ≥ 10 mm)
F025 Error in the linearization table	– Index markers are not continuously rising, for example illogical value pairs	– Check linearization table – Delete table/Create new
F036 No operable software	– Failed or interrupted software update	– Repeat software update – Check electronics version – Exchanging the electronics – Send instrument for repair
F040 Error in the electronics	– Hardware defect	– Exchanging the electronics – Send instrument for repair
F080 General software error	– General software error	– Disconnect operating voltage briefly
F105 Determine measured value	– The instrument is still in the start phase, the measured value could not yet be determined	– Wait for the end of the switch-on phase – Duration depending on the version and parameter adjustment up to approximately 3 min.
F113 Communication error	– EMC interference – Transmission error with the external communication with 4-wire power supply unit	– Remove EMC influences – Exchange 4-wire power supply unit or electronics

Code Text mes- sage	Cause	Rectification
F125 Impermissi- ble electronics temperature	– Temperature of the elec- tronics in the non-specified range	– Check ambient temperature – Isolate electronics – Use instrument with higher temperature range
F260 Error in the calibration	– Error in the calibration car- ried out in the factory – Error in the EEPROM	– Exchanging the electronics – Send instrument for repair
F261 Error in the instrument settings	– Error during setup – False signal suppression faulty – Error when carrying out a reset	– Repeat setup – Carry out a reset
F264 Installation/ Setup error	– Adjustment not within the vessel height/measuring range – Max. measuring range of the instrument not sufficient	– Check or correct installation and/or parameter adjust- ment – Use an instrument with big- ger measuring range
F265 Measurement function dis- turbed	– Sensor no longer carries out a measurement – Operating voltage too low	– Check operating voltage – Carry out a reset – Disconnect operating volt- age briefly

Function check

The following table shows the error codes and text messages in the status message "*Function check*" and provides information on causes as well as corrective measures.

Code Text mes- sage	Cause	Rectification
C700 Simulation ac- tive	– A simulation is active	– Finish simulation – Wait for the automatic end after 60 mins.

Out of specification

The following table shows the error codes and text messages in the status message "*Out of specification*" and provides information on causes as well as corrective measures.

Code Text mes- sage	Cause	Rectification
S600 Impermissi- ble electronics temperature	– Temperature of the elec- tronics in the non-specified range	– Check ambient temperature – Isolate electronics – Use instrument with higher temperature range

Code Text mes- sage	Cause	Rectification
S603 Impermissi- ble operating voltage	– Operating voltage below specified range	– Check electrical connection – if necessary, increase operating voltage

Maintenance

The following table shows the error codes and text messages in the status message "Maintenance" and provides information on causes as well as corrective measures.

Code Text mes- sage	Cause	Rectification
M500 Error with the reset delivery status	– With the reset to delivery status, the data could not be restored	– Repeat reset – Load XML file with sensor data into the sensor
M501 Error in the non-active linearization table	– Hardware error EEPROM	– Exchanging the electronics – Send instrument for repair
M502 Error in the event memory	– Hardware error EEPROM	– Exchanging the electronics – Send instrument for repair
M503 Meas. reliabil- ity too low	– The echo/noise ratio is too small for reliable measurement – Antenna dirty or defective	– Check installation and process conditions – Change polarisation direction – Use instrument with higher sensitivity – Clean the antenna
M504 Error on an device inter- face	– Hardware defect	– Check connections – Exchanging the electronics – Send instrument for repair
M505 No echo avail- able	– Sensor does not detect an echo during operation – Antenna dirty or defective	– Clean the antenna – Use a more suitable antenna/sensor – Remove possible false echoes – Optimize sensor position and orientation
M506 Installation/ Setup error	– Error during setup	– Check or correct installation and/or parameter adjustment

Code Text mes- sage	Cause	Rectification
M507 Error in the instrument settings	– Error during setup – Error when carrying out a reset – False signal suppression faulty	– Carry out reset and repeat setup

9.4 Rectify faults

Reaction when malfunctions occur

The operator of the system is responsible for taking suitable measures to rectify faults.

Procedure for fault rectification

The first measures are:

- Evaluation of fault messages, for example via the display and adjustment module
- Checking the output signal
- Treatment of measurement errors

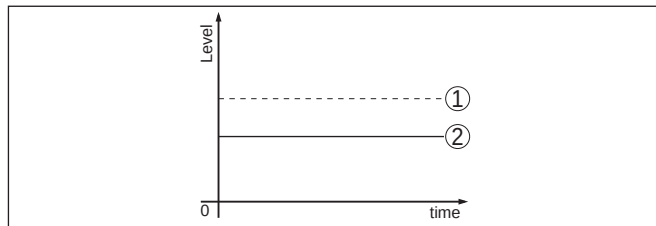
Further comprehensive diagnostics options are available with a PC with PACTware and the suitable DTM. In many cases, the reasons can be determined in this way and faults rectified.

Treatment of measurement errors with bulk solids

The below tables show typical examples for application-relevant measurement errors with bulk solids. A distinction is made between measurement errors during:

- Constant level
- Filling
- Emptying

The images in column "*Error pattern*" show the real level with a broken line and the level displayed by the sensor as a continuous line.



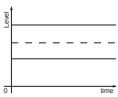
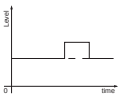
1 Real level

2 Level displayed by the sensor

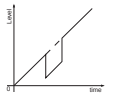
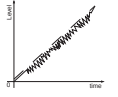
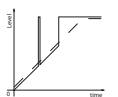
Notes:

- Wherever the sensor displays a constant value, the reason could also be the fault setting of the current output to "Hold value"
- If the level indication is too low, the reason could be a line resistance that is too high

Measurement error with constant level

Fault description	Error pattern	Cause	Rectification
1. Measured value shows a too low or too high level		- Min./max. adjustment not correct	- Adapt min./max. adjustment
		- Incorrect linearization curve	- Adapt linearization curve
2. Measured value jumps towards 100 %		- Due to the process, the amplitude of the product echo decreases	- Carry out a false signal suppression
		- A false signal suppression was not carried out	- Determine the reason for the changed false signals, carry out false signal suppression, e.g. with condensation
		- Amplitude or position of a false signal has changed (e.g. condensation, buildup); false signal suppression no longer matches actual conditions	

Measurement error during filling

Fault description	Error pattern	Cause	Rectification
3. Measured value jumps towards 0 % during filling		- Amplitude of a multiple echo (vessel top - product surface) is larger than the level echo	- Check parameter "Application", especially vessel top, type of medium, dished bottom, high dielectric constant, and adapt if necessary
		- The level echo cannot be distinguished from the false signal at a false signal position (jumps to multiple echo)	- Remove/reduce false signal: minimize interfering installations by changing the polarization direction - Chose a more suitable installation position
		- Transverse reflection from an extraction funnel, amplitude of the transverse reflection larger than the level echo	- Direct sensor to the opposite funnel wall, avoid crossing with the filling stream
4. Measured value fluctuates around 10 ... 20 %		- Various echoes from an uneven product surface, e.g. a material cone	- Check parameter "Type of medium" and adapt, if necessary - Optimize installation position and sensor orientation
		- Reflections from the product surface via the vessel wall (deflection)	- Select a more suitable installation position, optimize sensor orientation, e.g. with a swivelling holder
5. Measured value jumps sporadically to 100 % during filling		- Changing condensation or contamination on the antenna	- Carry out a false signal suppression or increase false signal suppression with condensation/contamination in the close range by editing - With bulk solids use radar sensor with purging air connection or flexible antenna cover

Measurement error during emptying

Fault description	Error pattern	Cause	Rectification
6. Measured value remains unchanged in the close range during emptying		- False signal larger than the level echo - Level echo too small	- Remove false signals in the close range. Check: Antenna must protrude out of the socket - Remove contamination on the antenna - Minimize interfering installations in the close range by changing the polarization direction - After removing the false signals, the false signal suppression must be deleted. Carry out a new false signal suppression
7. Measured value jumps sporadically towards 100 % during emptying		Changing condensation or contamination on the antenna	- Carry out false signal suppression or increase false signal suppression in the close range by editing - With bulk solids use radar sensor with purging air connection or flexible antenna cover
8. Measured value fluctuates around 10 ... 20 %		- Various echoes from an uneven product surface, e.g. an extraction funnel - Reflections from the product surface via the vessel wall (deflection)	- Check parameter "Type of medium" and adapt, if necessary - Optimize installation position and sensor orientation

Reaction after fault rectification

Depending on the reason for the fault and the measures taken, the steps described in chapter "Setup" must be carried out again or must be checked for plausibility and completeness.

24 hour service hotline

Should these measures not be successful, please call in urgent cases the VEGA service hotline under the phone no. **+49 1805 858550**.

The hotline is also available outside normal working hours, seven days a week around the clock.

Since we offer this service worldwide, the support is provided in English. The service itself is free of charge, the only costs involved are the normal call charges.

9.5 Exchanging the electronics module

If the electronics module is defective, it can be replaced by the user.



In Ex applications, only instruments and electronics modules with appropriate Ex approval may be used.

If there is no electronics module available on site, the electronics module can be ordered through the agency serving you. The electronics modules are adapted to the respective sensor and differ in signal output or voltage supply.

The new electronics module must be loaded with the default settings of the sensor. These are the options:

- In the factory
- Or on site by the user

In both cases, the serial number of the sensor is needed. The serial numbers are stated on the type label of the instrument, on the inside of the housing as well as on the delivery note.

When loading on site, first of all the order data must be downloaded from the Internet (see operating instructions manual "*Electronics module*").



Caution:

All user-specific settings must be entered again. Hence, you have to carry out a new setup after the electronics exchange.

If you have stored the data of the parameter adjustment during the first setup of the sensor, you can transfer these to the replacement electronics module. A new setup is no more necessary.

9.6 Software update

The following components are required to update the instrument software:

- Instrument
- Voltage supply
- Interface adapter VEGACONNECT
- PC with PACTware
- Current instrument software as file

You can find the current instrument software as well as detailed information on the procedure under "www.vega.com/downloads" and "*Software*".



Caution:

Instruments with approvals can be bound to certain software versions. Therefore make sure that the approval is still effective after a software update is carried out.

You can find detailed information at www.vega.com/downloads and "*Approvals*".

9.7 How to proceed if a repair is needed

You can find a repair form as well as detailed information on how to proceed at www.vega.com/downloads and "*Forms and certificates*".

By doing this you help us carry out the repair quickly and without having to call back for needed information.

If a repair is necessary, please proceed as follows:

- Print and fill out one form per instrument
- Clean the instrument and pack it damage-proof
- Attach the completed form and, if need be, also a safety data sheet outside on the packaging
- Please contact the agency serving you to get the address for the return shipment. You can find the agency on our home page www.vega.com.

10 Dismount

10.1 Dismounting steps

**Warning:**

Before dismounting, be aware of dangerous process conditions such as e.g. pressure in the vessel or pipeline, high temperatures, corrosive or toxic products etc.

Take note of chapters "*Mounting*" and "*Connecting to power supply*" and carry out the listed steps in reverse order.

10.2 Disposal

The instrument consists of materials which can be recycled by specialised recycling companies. We use recyclable materials and have designed the parts to be easily separable.

Correct disposal avoids negative effects on humans and the environment and ensures recycling of useful raw materials.

Materials: see chapter "*Technical data*"

If you have no way to dispose of the old instrument properly, please contact us concerning return and disposal.

WEEE directive 2002/96/EG

This instrument is not subject to the WEEE directive 2002/96/EG and the respective national laws. Pass the instrument directly on to a specialised recycling company and do not use the municipal collecting points. These may be used only for privately used products according to the WEEE directive.

11 Supplement

11.1 Technical data

General data

316L corresponds to 1.4404 or 1.4435

Materials, wetted parts

– Process fitting	316L, Alloy C22, Alloy 400
– Process seal	On site
– Antenna	316L, PP, PEEK
– seal, antenna system	FKM (SHS FPM 70C3 GLT), EPDM (COG AP310)

Materials, non-wetted parts

– Plastic housing	plastic PBT (Polyester)
– Aluminium die-casting housing	Aluminium die-casting AlSi10Mg, powder-coated - basis: Polyester
– Stainless steel housing	316L
– Seal between housing and housing cover	NBR (stainless steel housing, precision casting), silicone (aluminium/plastic housing; stainless steel housing, electropolished)
– Inspection window in housing cover (optional)	Polycarbonate
– Ground terminal	316L

Process fitting

– Flanges	DIN from DN 80, ASME from 3"
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Weights

– Instrument (depending on housing, process fitting and antenna)	approx. 2 ... 17.2 kg (4.409 ... 37.92 lbs)
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Torque for NPT cable glands and Conduit tubes

– Plastic housing	max. 10 Nm (7.376 lbf ft)
– Aluminium/Stainless steel housing	max. 50 Nm (36.88 lbf ft)

Input variable

Measured variable	The measured variable is the distance between the process fitting of the sensor and the product surface. The reference plane is the seal surface of the flange.
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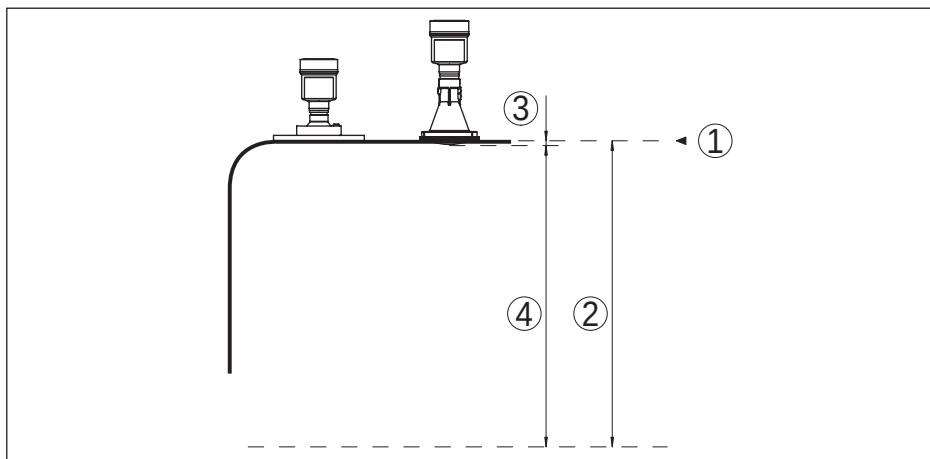


Fig. 42: Data of the input variable

- 1 Reference plane
- 2 Measured variable, max. measuring range
- 3 Antenna length
- 4 Useful measuring range

Max. measuring range 120 m (393,7 ft)

Accuracy (according to DIN EN 60770-1)

Process reference conditions according to DIN EN 61298-1

- Temperature +18 ... +30 °C (+64 ... +86 °F)
- Relative humidity 45 ... 75 %
- Air pressure 860 ... 1060 mbar/86 ... 106 kPa (12.5 ... 15.4 psig)

Installation reference conditions

- Min. distance to internal installations > 200 mm (7.874 in)
- Reflector Flat plate reflector
- False reflections Biggest false signal, 20 dB smaller than the useful signal

Deviation See following diagrams

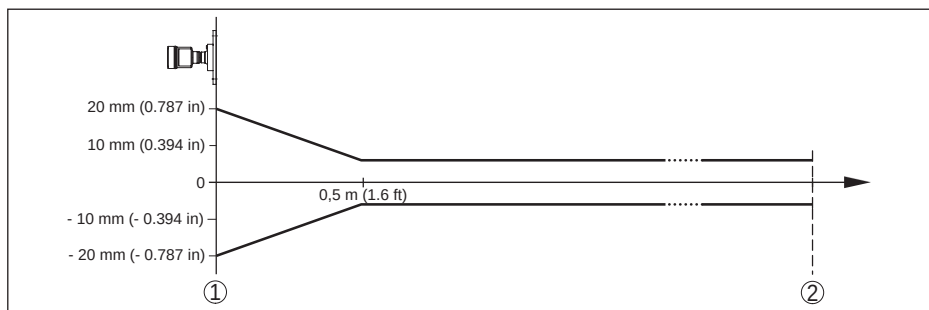


Fig. 43: Deviation under reference conditions

- 1 Reference plane
2 Measuring range end

Repeatability	$\leq \pm 1$ mm
Deviation with bulk solids	The values depend to a great extent on the application. Binding specifications are thus not possible.
Deviation under EMC influence	$\leq \pm 50$ mm

Characteristics and performance data

Measuring frequency	W-band (79 GHz technology)
Measuring cycle time approx.	700 ms
Step response time ¹⁾	≤ 3 s
Beam angle ²⁾	
– Plastic horn antenna	3.5°
– Metal jacketed lens antenna	4°
Emitted HF power (depending on the parameter adjustment) ³⁾	
– Average spectral transmission power density	-3 dBm/MHz EIRP
– Max. spectral transmission power density	+34 dBm/50 MHz EIRP
– Max. power density at a distance of 1 m	$< 3 \mu\text{W}/\text{cm}^2$

Ambient conditions

Ambient, storage and transport temperature -40 ... +80 °C (-40 ... +176 °F)

Process conditions

For the process conditions, please also note the specifications on the type label. The lowest value always applies.

Process temperature

- ¹⁾ Time span (after a sudden measuring distance change of max. 2 m in bulk solids applications) until the output signal has taken on 90 % of the final value for the first time (IEC 61298-2).
²⁾ Outside the specified beam angle, the energy of the radar signal is reduced by 50 % (-3 dB)
³⁾ EIRP: Equivalent Isotropic Radiated Power

Seal	Antenna lens	Process temperature (measured on the process fitting)
FKM (SHS FPM 70C3 GLT)	PEEK	-40 ... +130 °C (-40 ... +266 °F)
	PEEK	-40 ... +200 °C (-40 ... +392 °F)
FKM (SHS FPM 70C3 GLT)	PP	-40 ... +80 °C (-40 ... +176 °F)
EPDM (COG AP310)	PP	-40 ... +80 °C (-40 ... +176 °F)

Ambient temperature - Process temperature

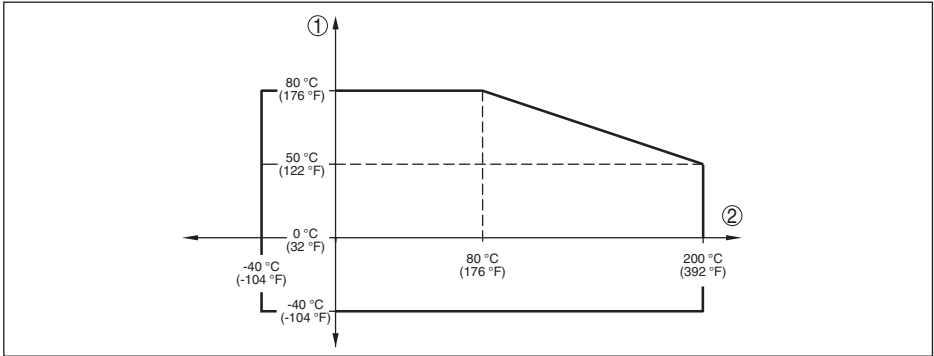


Fig. 44: Ambient temperature - Process temperature, metal jacketed lens antenna up to +200 °C (392 °F)

- 1 Ambient temperature
- 2 Process temperature

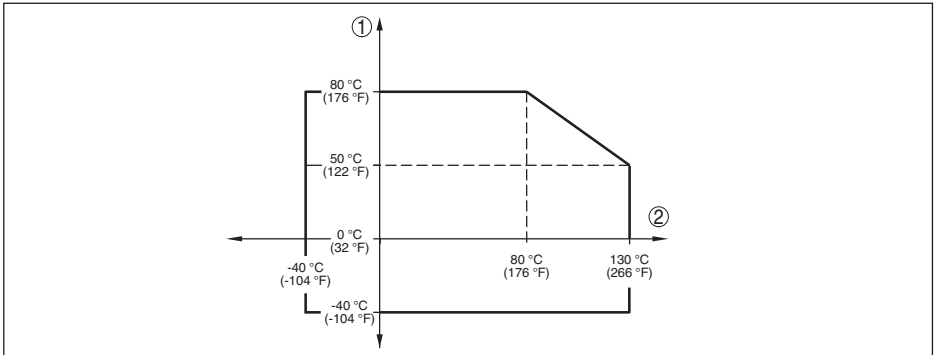


Fig. 45: Ambient temperature - Process temperature, metal jacketed lens antenna up to +130 °C (266 °F)

- 1 Ambient temperature
- 2 Process temperature

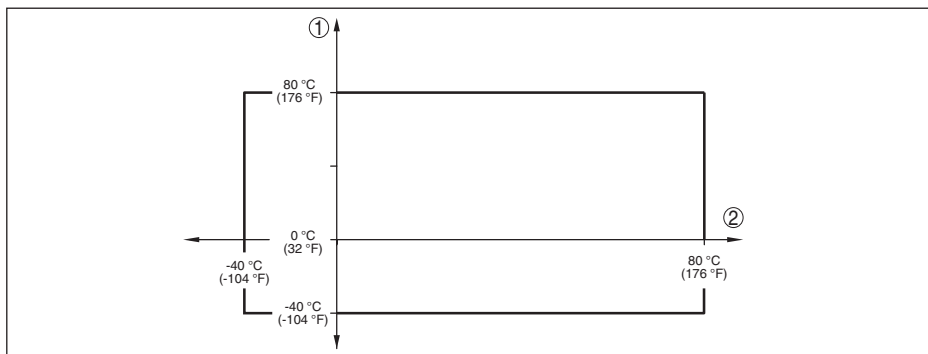


Fig. 46: Ambient temperature - Process temperature, plastic horn antenna

- 1 Ambient temperature
2 Process temperature

Vessel pressure

Vessel pressure

- Metal jacketed lens antenna -1 ... 3 bar (-100 ... 300 kPa/-14.5 ... 43.5 psig)
- Plastic horn antenna -1 ... 2 bar (-100 ... 200 kPa/-14.5 ... 29.1 psig)
- Plastic horn antenna - Version with adapter flange from DN 100 PP or PP-GF 30 -1 ... 1 bar (-100 ... 100 kPa/-14.5 ... 14.5 psig)

Vessel pressure relating to the flange nominal pressure stage

see supplementary instructions manual "Flanges according to DIN-EN-ASME-JIS"

Mechanical stresses

Vibration resistance - Metal jacketed lens antenna 4 g at 5 ... 200 Hz according to EN 60068-2-6 (vibration with resonance)

Vibration resistance - Plastic horn antenna

- With adapter flange 2 g at 5 ... 200 Hz according to EN 60068-2-6 (vibration with resonance)
- with mounting strap 1 g at 5 ... 200 Hz according to EN 60068-2-6 (vibration with resonance)

Shock resistance

100 g, 6 ms according to EN 60068-2-27 (mechanical shock)

Data rinsing air connection - Metal jacketed lens antenna

Max. permissible pressure 6 bar (87.02 psig)

Air volume, depending on pressure (recommended area)

Pressure	Air volume	
	Without reflux valve	With reflux valve
0.2 bar (2.9 psig)	1.7 m ³ /h	-
0.4 bar (5.8 psig)	2.5 m ³ /h	-
0.6 bar (8.7 psig)	2.9 m ³ /h	0.8 m ³ /h

Pressure	Air volume	
	Without reflux valve	With reflux valve
0.8 bar (11.6 psig)	3.3 m³/h	1.5 m³/h
1 bar (14.5 psig)	3.6 m³/h	2.0 m³/h
1.2 bar (17.4 psig)	3.9 m³/h	2.3 m³/h
1.4 bar (20.3 psig)	4.0 m³/h	2.7 m³/h
1.6 bar (23.2 psig)	4.3 m³/h	3.0 m³/h
1.8 bar (20.3 psig)	4.5 m³/h	3.5 m³/h
2 bar (23.2 psig)	4.6 m³/h	4.0 m³/h

Thread

G $\frac{1}{8}$

Closure

Threaded plug of 316Ti

Reflux valve - unmounted (as option with non-Ex version, included in the scope of delivery with Ex version)

- Material 316Ti
- Thread G $\frac{1}{8}$
- Seal FKM (SHS FPM 70C3 GLT), EPDM (COG AP310)
- For connection G $\frac{1}{4}$
- opening pressure 0.5 bar (7.25 psig)
- Nominal pressure stage PN 250

Electromechanical data - version IP 66/IP 67 and IP 66/IP 68; 0.2 bar

Cable gland M20 x 1.5 or $\frac{1}{2}$ NPT

Wire cross-section (spring-loaded terminals)

- Massive wire, stranded wire 0.2 ... 2.5 mm² (AWG 24 ... 14)
- Stranded wire with end sleeve 0.2 ... 1.5 mm² (AWG 24 ... 16)

Electromechanical data - version IP 66/IP 68 (1 bar)

Options of the cable entry

- Cable gland with integrated connection cable M20 x 1.5 (cable: $\varnothing$ 5 ... 9 mm)
- Cable entry $\frac{1}{2}$ NPT
- Blind plug M20 x 1.5; $\frac{1}{2}$ NPT

Connection cable

- Wire cross-section 0.5 mm² (AWG 20)
- Wire resistance < 0.036 Ω /m
- Tensile strength < 1200 N (270 lbf)
- Standard length 5 m (16.4 ft)
- Max. length 180 m (590.6 ft)
- Min. bending radius 25 mm (0.984 in) with 25 °C (77 °F)
- Diameter approx. 8 mm (0.315 in)
- Colour - Non-Ex version Black

– Colour - Ex-version Blue

Display and adjustment module

Display element Display with backlight

Measured value indication

- Number of digits 5
- Size of digits W x H = 7 x 13 mm

Adjustment elements 4 keys

Protection rating

- unassembled IP 20
- mounted in the housing without lid IP 40

Materials

- Housing ABS
- Inspection window Polyester foil

Display and adjustment elements

Display elements

- Green LED in the supply room Indication of the charging process
- Yellow LED in the supply room Indication of the charging condition

Adjustment elements

- Rotary switch in the supply room Selection of the mode
- Button outside on the housing Switching on and off

Integrated clock

Date format Day.Month.Year

Time format 12 h/24 h

Time zone Ex factory CET

Rate deviation max. 10.5 min/year

Measurement electronics temperature

Resolution 0.1 °C (1.8 °F)

Accuracy ±1 °C (1.8 °F)

Permissible temperature range -40 ... +85 °C (-40 ... +185 °F)

External battery charger

Mains voltage 100 ... 240 V AC

Output voltage 24 V DC

Output current (shortcircuit proof) max. 500 mA

Load current limitation 70 mA

DC plug (inside plus, outside minus) 2.1 mm

Electrical protective measures

Protection rating

Housing material	Version	IP-protection class	NEMA protection
Plastic	Single chamber	IP 66/IP 67	NEMA 4X
	Double chamber	IP 66/IP 67	NEMA 4X
Aluminium	Single chamber	IP 66/IP 68 (0.2 bar)	NEMA 6P
		IP 68 (1 bar)	NEMA 6P
	Double chamber	IP 66/IP 67	NEMA 4X
		IP 66/IP 68 (0.2 bar) IP 68 (1 bar)	NEMA 6P NEMA 6P
Stainless steel, electro-polished	Single chamber	IP 66/IP 68 (0.2 bar)	NEMA 6P
Stainless steel, precision casting	Single chamber	IP 66/IP 68 (0.2 bar)	NEMA 6P
		IP 68 (1 bar)	NEMA 6P
	Double chamber	IP 66/IP 67 IP 66/IP 68 (0.2 bar) IP 68 (1 bar)	NEMA 4X NEMA 6P NEMA 6P

Overvoltage category III⁴⁾

Protection class III⁵⁾

11.2 Radio astronomy stations

The following table shows the geographic position of the radio astronomy stations in Europe:

Country	Name of the Station	Geographic Latitude	Geographic Longitude
Finland	Metsähovi	60°13'04" N	24°23'37" E
	Tuorla	60°24'56" N	24°26'31" E
France	Plateau de Bure	44°38'01" N	05°54'26" E
	Floirac	44°50'10" N	00°31'37" W
Germany	Effelsberg	50°31'32" N	06°53'00" E
Hungary	Penc	47°47'22" N	19°16'53" E
Italy	Medicina	44°31'14" N	11°38'49" E
	Noto	36°52'34" N	14°59'21" E
	Sardinia	39°29'50" N	09°14'40" E
Poland	Krakow- Fort Skala	50°03'18" N	19°49'36" E
Russia	Dmitrov	56°26'00" N	37°27'00" E
	Kalyazin	57°13'22" N	37°54'01" E
	Pushchino	54°49'00" N	37°40'00" E
	Zelenchukskaya	43°49'53" N	41°35'32" E
Spain	Yebes	40°31'27" N	03°05'22" W
	Robledo	40°25'38" N	04°14'57" W

⁴⁾ IEC 61010-1

⁵⁾ IEC 61010-1

Country	Name of the Station	Geographic Latitude	Geographic Longitude
Switzerland	Bleien	47°20'26" N	08°06'44" E
Sweden	Onsala	57°23'45" N	11°55'35" E
UK	Cambridge	52°09'59" N	00°02'20" E
	Darnhall	53°09'22" N	02°32'03" W
	Jodrell Bank	53°14'10" N	02°18'26" W
	Knockin	52°47'24" N	02°59'45" W
	Pickmere	53°17'18" N	02°26'38" W

11.3 Dimensions

The following dimensional drawings represent only an extract of all possible versions. Detailed dimensional drawings can be downloaded at www.vega.com/downloads under "Drawings".

Housing

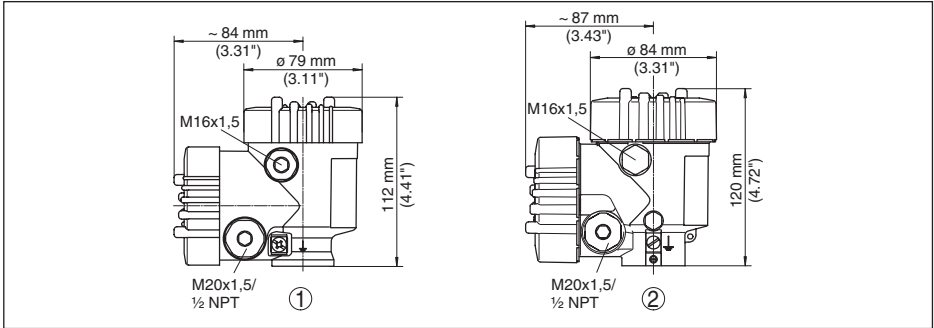


Fig. 47: Dimensions housing - with integrated display and adjustment module the housing is 9 mm/0.35 in higher

- 1 Plastic housing
- 2 Aluminium/Stainless steel housing

VEGAPULS 69, plastic horn antenna with compression flange

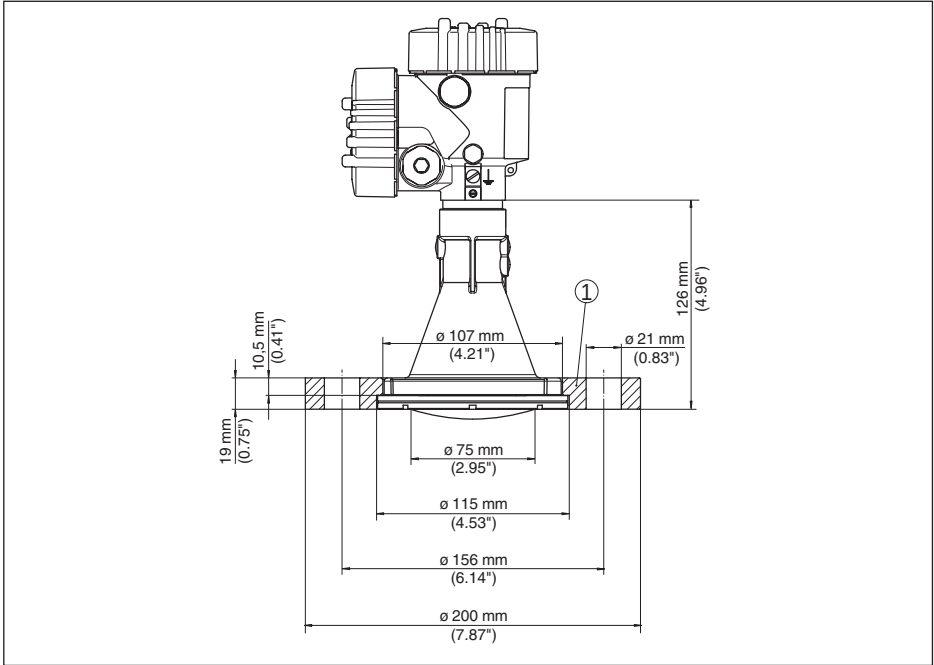


Fig. 48: VEGAPULS 69, plastic horn antenna, compression flange

1 Compression flange

VEGAPULS 69, plastic horn antenna with adapter flange

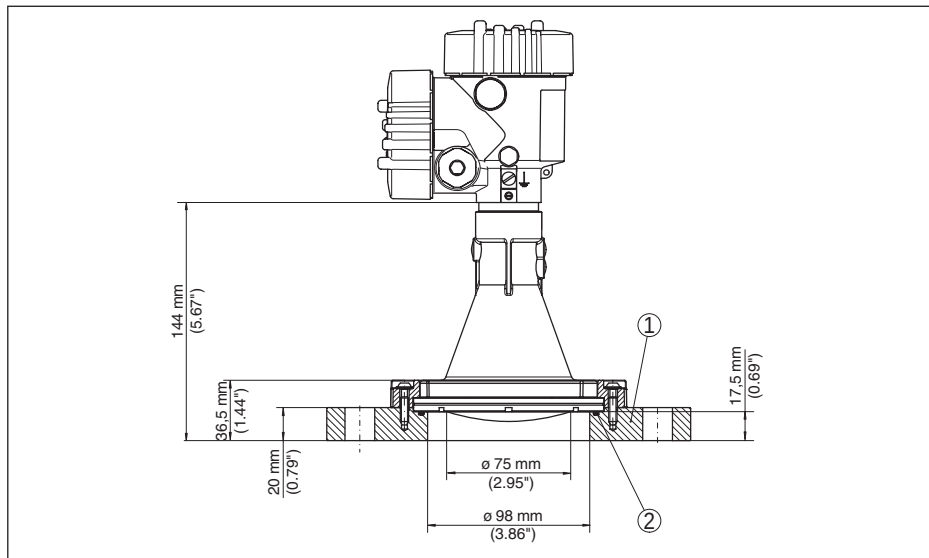


Fig. 49: VEGAPULS 69, plastic horn antenna, adapter flange

VEGAPULS 69, plastic antenna and mounting strap

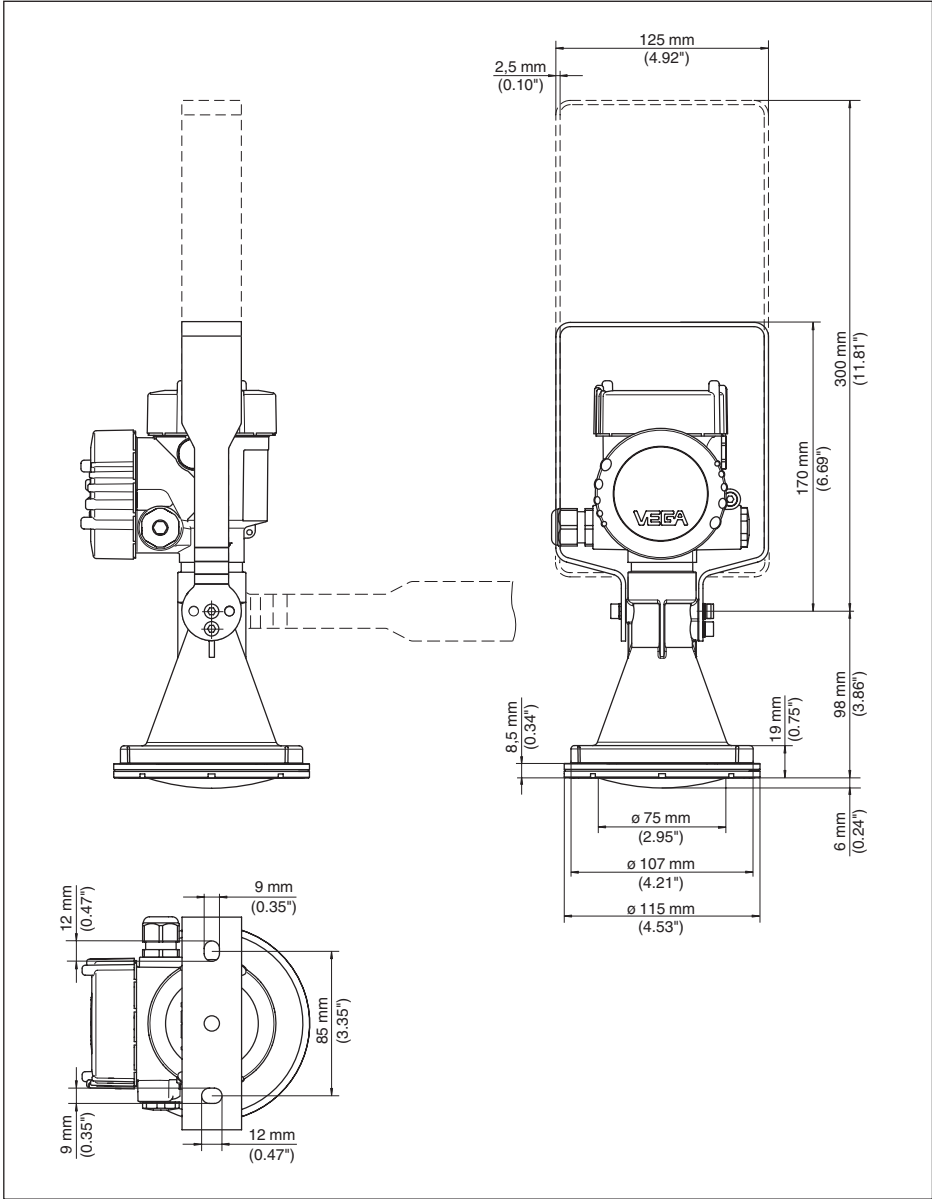


Fig. 50: VEGAPULS 69, plastic antenna and mounting strap in 170 or 300 mm length

47248-EN-140707

VEGAPULS 69, metal jacketed lens antenna

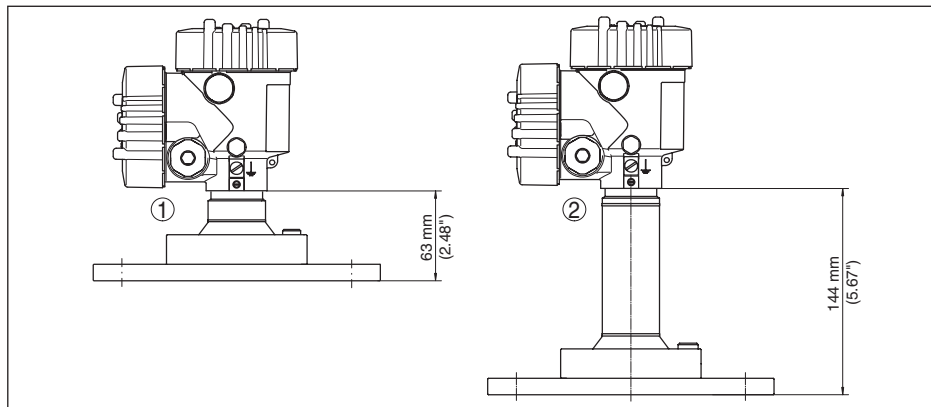


Fig. 51: VEGAPULS 69, metal jacketed lens antenna

VEGAPULS 69, metal jacketed lens antenna and swivelling holder

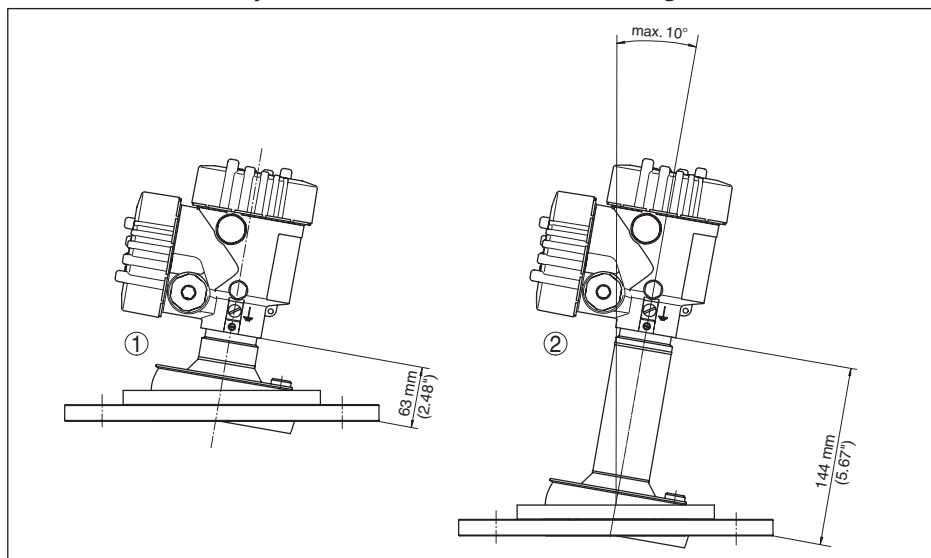


Fig. 52: VEGAPULS 69, metal jacketed lens antenna and swivelling holder

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INDEX

A

- Adjustment 39, 40
- Application
 - Bulk solid 36
 - Liquid 32
 - Standpipe 32

C

- Connecting
 - To the PC 46
- Curve indication
 - Echo curve 41
 - False signal suppression 41

D

- Default values 44
- Deviation 54

E

- Echo curve memory 49
- Echo curve of the setup 41
- EDD (Enhanced Device Description) 48
- Electronics compartment 26
- Error codes 52
- Event memory 49

F

- False signal suppression 41
- Fault rectification 54
- Functional principle 9

L

- Linearisation curve 43

M

- Main menu 31
- Meas. reliability 40
- Measured value memory 49
- Mounting
 - Flange 14
 - Strap 12

N

- NAMUR NE 107 51, 53

O

- Operation
 - System 30
- Overfill protection according to WHG 43

P

- Peak value indicator 40
- Polarisation 15

R

- Reflection properties 32
- Repair 57
- Replacement parts
 - Supplementary electronics power pack 11
- Reset 43

S

- Service hotline 56
- Socket 18
- Status messages - NAMUR NE 107 50

T

- Type label 8

V

- Vessel form 38
- Vessel height 38
- Vessel installations 22
- Vessel insulation 23
- Voltage supply 10



Printing date:

All statements concerning scope of delivery, application, practical use and operating conditions of the sensors and processing systems correspond to the information available at the time of printing.

Subject to change without prior notice

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